



COLONY OF MAURITIUS

DEPARTMENT OF AGRICULTURE

SIXTH ANNUAL REPORT
OF THE SUGARCANE
RESEARCH STATION,
FOR THE YEAR
1935.

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SIXTH ANNUAL REPORT OF THE SUGARCANE RESEARCH STATION, FOR THE YEAR 1935.

INTRODUCTION

BY THE OFFICER IN CHARGE.

The Station was below strength for the greater part of the year as Dr. Evans, the Physiological Botanist, was absent on leave from 24th March to 8th December and Mr. Halais, Scientific Assistant, from 11th March to 25th November.

Two meetings of the recently formed Research Advisory Committee of the Station were held during the earlier part of the year at which the current research programmes for cane-breeding, bio-chemistry and physiological botany were fully discussed and approved.

The Board of the Mauritius College of Agriculture and the Committee of the Sugar Industry Reserve Fund of the Chamber of Agriculture contributed Rs. 18,000 and Rs. 14,000 respectively towards the cost of the Station during the year, the difference of Rs. 33,100 being met from Colonial Government funds.

At the Inter-Colonial Exhibition held in Port Louis during the Bi-Centenary celebrations in August, the Station staged a well attended exhibit illustrating some of its main activities.

Detailed reports on the work of the three divisions of the Station for 1935 follow below.

PART I—CANE BREEDING

BY A. GLENDON HILL.

GENERAL

The cane-breeding policy remained unchanged during the year: the programme being the same as that published in previous annual reports. Marked progress, in the search for improved seedling varieties, to replace the older kinds now grown, was made during 1935 as the best clones from the first seedlings to be bred by the Station when it opened, six years ago, reached the field trial stage. These were planted in field trials on two experimental stations and also in over thirty multiplication plots throughout the Island preparatory to establishing them in numerous field trials, early in 1936, under the very diverse conditions found in the different districts. Later in the year two of the 1931 series of seedlings were also sent out for field trials. As only thirteen* of approximately 53,000 seedlings bred in 1930 reached this field trial stage, after surviving their 3rd-trials on experimental stations as virgin or plant canes, it will be realised that the standard set has been high, no seedling normally being kept unless it had proved superior in yield to the controls, or standard varieties, used in the 2nd and 3rd-trials. In the writer's opinion the best seedling varieties sent out for field trials in 1935 were M.171/30 and M.73/31 both of which appear very promising. The parentage and performance of these, and all other new seedling varieties sent out for field trials to date, is shown in Table II on page 9 below.

The chief desiderata in this search for better varieties is the need for (1) a *grande saison* cane for the present Tanna growing areas, chiefly in the uplands; (2) a *petite saison* cane for the lowlands and (3) a Phytalus resistant type for those regions in the uplands and lowlands which are badly infested

* Since reduced to ten.

with this white grub. In making selections for the above areas, apart from the usual considerations, particular attention has been given to producing non-arrowing varieties, flowering being a common and very unpopular fault in many otherwise excellent seedling canes.

From 1936 onwards the Station should be in a position to maintain a regular supply of high-grade sugarcane varieties for distribution and trial on estates; and as Mauritius is one of the few sugarcane countries where the old named varieties have not yet been replaced by improved seedling varieties a considerable increase in sugar output per acre may be expected in the future, judging by experience elsewhere. At present, over 50% of the area grown is still under White Tanna*, a variety that has, in the past given steady returns in most districts—a tribute not only to this cane but also to the Planters who, by careful field methods, have grown it for 45 years without allowing it to “run out.”

CANE-BREEDING AND SELECTION WORK, 1935.

A summary of the breeding work carried out in 1935, compared with that of previous years, is given in Table I below.

78,500 seedlings from 356 crosses made by the methods described in previous reports were raised at Réduit and Pamplemousses experimental stations during the period May to August, a complete list of these crosses being given on pages 16 to 20.

No alterations of any account were made in breeding technique, apart from the attempt to breed from so called non-arrowing varieties. As already stated above, the most popular cane in large areas of the island is still White Tanna and, where conditions are suitable and it is still free from disease, its performance is admirable although sucrose content is not notably high. For this reason a serious attempt has been made since 1930 to breed daughter-types from Tanna but, owing to its non-flowering nature, and the almost invariable sterility of the inflorescences occasionally found, considerable difficulty has been experienced in obtaining any seedlings from it. For instance, in 1930-31 when this variety arrowed to a certain extent, over 600 arrows were planted but only 3 seedlings obtained. In 1934 the experiment of allowing 1st-ratoon canes of Tanna to stand over for 24 months, instead of the usual 12, was tried as a possible method of inducing flowering, the supposition being that a slow-growing variety might also be slow to mature sexually. As a reasonable proportion of fertile arrows of Black Tanna were obtained in 1935 from these 2 year old canes, but not from the controls, it is possible that a simple method for inducing arrowing may have been evolved. The experiment is to be repeated with other non-arrowing varieties in future.

* A local sport of Striped Tanna discovered about 1893.

TABLE I

SUMMARY OF CANE-BREEDING WORK 1930 TO 1935.

	1930	1931	1932	1933	1934	1935
Controlled crosses made, including selfings...	409	355	457	466	421	356
Uncontrolled crosses	569	370	46	1	nil	nil
1st-Year seedlings raised in boxes	52,840	72,888	157,948	64,883	95,105	78,572
" planted out on experimental stations	18,888	22,011	23,016	18,993	20,734	14,724
" distributed to estates for planting ...	3,000	5,000	16,040	3,645	4,550	nil
Selections made from 1st-year populations for 2nd-trials	253	263	252	250	—	—
" " 2nd-trials above for 3rd-trials...	46	56	60	—	—	—
" " 3rd-trials above for field trials...	13†	5*	—	—	—	—

† Of which 3 have since been condemned.

* Not yet completed.

1st-Trial Seedlings.—Approximately 14,700 seedlings bred during the year were transplanted into the field from pots during the period November-December. This represents a reduction in the number planted out last year, due to the elimination of those populations which have proved unproductive in the past (vide page 10 below). These 1st-trial seedlings had stools of standard varieties interplanted amongst them in the field to act as a basis of comparison when making selections later.

From approximately 19,000 1933-seedlings planted out at Réduit and Pamplémousses experimental stations, 250 selections were made, or 1.3%, a higher proportion than usual.

In December, 88 selections were made from 9,800 1934-seedlings planted at Pamplémousses leaving the Réduit seedlings to be selected later. These 88 selections were planted in propagation rows preparatory to replanting them in 2nd-trials at the proper season next April-June. The Pamplémousses seedlings were extremely difficult to select as they had been severely attacked by Spotted Borers so that scarcely a single stem escaped attack, while no immune stools were to be found. In making selections from the 1st-trial seedlings particular attention was again given to finding late-maturing or grande saison types, which, owing to the smothering effect of quicker growing neighbours, are frequently so much suppressed as to go undetected amongst 1st-trial populations. Very wide spacing might be a palliative were sufficient land available.

2nd-Trial Seedlings.—The 250 selections from the 1933-seedlings referred to above were put into 21 2nd-trials consisting of small-scale randomised blocks, each of 9 to 14 varieties, plus a control, planted in four blocks with three holes of each variety per block or 12 holes in all. This arrangement has been found more satisfactory for making observations than the latin square lay-out of 10 x 10 holes previously used. Normally, planting material for these 2nd-trials is of poor quality owing to the large percentage of body-cuttings that must be used, but since adopting the practice of soaking cuttings in a saturated solution of lime for 12 hours before planting, very satisfactory germinations have been obtained.

Nine 2nd-trials were cut during the year and 24 seedlings out of 89 retained for 3rd-trials.

3rd-Trial Seedlings.—Fourteen 3rd-trials containing 64 selections were laid down during the year, and 14 similar trials cut, from which eleven seedling varieties out of 63 were retained for planting in field trials throughout the Island, preparatory to deciding which varieties should be released for general distribution. The parentage and performance of these seedlings is shown in Table II on page 9. A change has recently been made in the layout of these 3rd and subsequent trials, in that the outside rows on the long sides of each individual plot are now treated as buffer rows and discarded at harvest, in order to minimise varietal interaction which has been found to be considerable at times, particularly when comparing noble with 3rd and 4th-nobilised Glagah types. By discarding these two bordered lines, a buffer-area, 9' to 10' wide, is thereby established between the long sides of each pair of plots. This is thought to be ample, judging by the observations made during root-studies recently carried out at the Station.

As in the past, routine tests for Gummosis resistance were carried out by the Mycologist of the Department of Agriculture at the same time as the above 3rd-trials. The results from these Gummosis tests have been of considerable assistance in selection work.

It is hoped that tests to determine the resistance of seedlings to Leaf-Scald will also be evolved as the result of experiments now being carried out by the Mycologist,

TABLE II

PERFORMANCE IN 3RD-TRIALS OF ALL NEW "M" SEEDLINGS RETAINED TO-DATE FOR FIELD TRIALS.

Variety	Parentage	Yield of cane, tons p/arpent	Yield of Sucrose t.p.a.	1930 SERIES			Arrows per 100 canes	Age	Yield of control Tons per arpent		Location of 3rd-trial
				Sucrose % cane	Purity of Juice	Arrows per 100 canes			Cane	Sucrose	
M. 5/30	R.P.6	x 131.P	...	12.5	89.2	5	21½	mths.	12.8†	1.68	Réduit.
M. 10/30	"	x "	...	12.6	90.7	0	21½	"	12.8†	1.68	"
M. 13/30	R.P.6 (uncontrolled)	...	...	13.1	89.0	0	21½	"	12.8†	1.68	"
M. 28/30	Ba.11569	x M.27/16	...	15.5	90.8	0	21½	"	11.4	1.63	"
M. 28/30	"	"	...	13.7	91.0	2	21	"	24.8	3.77	Pamplermousses.
M. 48/30	R.P.6	x Senneville	...	14.1	89.0	28	21	"	24.8	3.77	"
M. 71/30	Ba.11569	x 131.P	...	14.2	86.9	0	14½	"	11.4	1.63	Réduit.
M. 106/30*	POJ.2878	x Uba Marot	...	12.5	82.6	57	14½	"	11.4	1.63	"
M. 108/30	"	"	...	14.3	83.9	22	14½	"	11.4	1.63	"
M. 113/30	R.P.6	x M.23/16	...	12.7	90.2	1	22½	"	46.0	6.03	Pamplermousses.
M. 113/30	"	"	...	12.2	84.3	11	19½	"	55.8	7.48	Réduit.
M. 151/30	"	x M.35/17	...	—	—	0	24	"	38.7	—	"
M. 163/30*	M.20/16	x "	...	12.9	91.2	0	22½	"	46.0	6.03	Pamplermousses.
M. 163/30	"	"	...	13.9	89.2	3	19½	"	55.3	7.51	Réduit.
M. 171/30	R.P.6	x M.27/16	...	14.4	92.1	0	21	"	43.9	5.70	Pamplermousses.
M. 171/30	"	"	...	15.1	93.0	2	19½	"	55.3	7.51	Réduit.
M. 186/30*	R.P.6	x 131.P	...	11.9	90.2	0	21	"	43.9	5.70	Pamplermousses.
M. 186/30	"	"	...	14.6	90.1	2	18½	"	44.2	5.96	Réduit.
M. 9/31	POJ.2878	x Uba Marot	...	12.2	84.1	40	21	mths.	38.9	5.55	Pamplermousses.
M. 22/31	"	x "	...	12.9	83.0	38	21	"	38.9	5.55	"
M. 41/31	"	x "	...	12.0	86.5	60	19½	"	22.4	3.14	Réduit.
M. 72/31	"	x M.35/17	...	15.5	88.0	0	13.6	"	45.8	7.55	"
M. 73/31	"	x M.109/26	...	15.8	91.5	0	13.6	"	45.8	7.55	"
Mean	...	...	...	—	—	—	—	—	32.8	4.56	

* Now discarded.

† Yields suffered severely through drought.

(d) *Field Trial Selections.*—These consist of those new seedling varieties which survive their 3rd-trials, as plant canes, under experimental station conditions. A tabular summary showing the parentage and 3rd-trial performance of all those seedlings that have reached the field trial selection stage to date is given above in Table II. After surviving these field trials, which are being conducted in co-operation with certain representative estates, it is felt that sufficient will be known about each approved variety to warrant its release for general distribution and subsequent trial, not only as plant canes, but also as ratoons, which are commonly grown in Mauritius for six seasons after the virgin, or plant crop, has been taken. Owing to the small extent of the two experimental stations, it would be impossible to conduct extensive ratooning tests were it not for the willing co-operation of numerous Planters who have placed land and labour at the disposal of the Station for experimental purposes.

The only seedling variety bred by the Station to be released for general distribution to date is M.108/30, a seedling of POJ.2878 x Uba Marot, intended for Phylatus infested areas where its very vigorous root-system should protect it against the destruction that often overtakes other varieties when attacked by Phylatus larvæ. The promising new varieties M.171/30 and M.73/31 will be, in all probability, released for general distribution in 1936.

On page 11 of this report a list of introduced varieties recommended for trial is given.

MISCELLANEOUS INVESTIGATIONS

Analysis of Parentage.—Since the opening of the Station a considerable number of trial marriages have, of necessity, been made in order to gain information as to the relative merits of the various parent canes available. Many of these trial crosses, although apparently unpromising, were repeated each year in order to confirm previous suspicions, but by 1935 it was felt that the time had come to eliminate those combinations that had yielded no selections in the past. An analysis of the parentage of all 1930, 1931, 1932 and 1933-seedlings selected for 2nd and 3rd-trials was subsequently carried out which clearly indicated the relative productivity of the successful parent combinations, as regards selections produced, and also those undesirable male and female parents which together, or in combination with parents of proved value, result in worthless populations. The weekly list of crosses to be made at each station in 1935 was based on this analysis which moreover showed that 29,200 out of a total of 82,900, or 35%, of the 1st-year populations planted out between 1930 and 1933 yielded no selections. By eliminating these useless combinations it will be possible to reduce the number of 1st-year seedlings planted in the field annually without reducing the effective population. This examination demonstrated the outstanding value of POJ.2878 and R.P.6 as female parents and of Uba Marot, M. 27/16 and M.35/17 as males.

The following are notes on various investigations carried out by the Cane Breeding Officer during the year:—

Sampling Methods.—This investigation was carried out to check the accuracy of the present composite method used in sampling yield trials. From an area equivalent to that of an ordinary Randomised Block yield trial, but under one variety, a plot of four rows was taken at random in each of the six blocks.

From each of these plots 20 samples of 2 canes each were taken at random, and each of these samples grouped with similar samples from the other plots, thus giving 20 samples of 12 canes each. Since the Standard

Error of the Sucrose % Cane figure of a single sample was found to be only 2.5%, it would appear that the method of taking and analysing one composite sample per variety in a yield trial, can safely be substituted for the more usual and tedious method of crushing and analysing a separate sample from every plot of each variety from which to obtain the mean.

Border Effect in Variety Trials.—An analysis of the observed differences in plot yields from 3-row plots calculated (1) from the middle rows only and (2) by taking all three rows, showed that in 57% of the varieties in the three yield trials examined border effect was evident; thus supporting the present practice of establishing a buffer area of two rows between each pair of plots in variety trials.

Correlation Studies.—In 126 samples crushed for juice analysis the correlation between Sucrose % grs. juice and Sucrose % Cane (richesse) was found to be $+ 0.917 \pm 0.014$ and the correlation between the weight of the sample and the weight of juice obtained $+ 0.914 \pm 0.015$.

VARIETY TRIALS OTHER THAN THOSE WITH NEW VARIETIES BRED BY THE STATION

Since the opening of the Station, in 1930, co-operative variety trials have been conducted, throughout the Island, with all the available local or introduced varieties thought to be of promise. The results of these trials to-date have been published annually, and demonstrate the best varieties amongst those tested in the various districts. The results from those trials cut in 1935 show the high yielding capacity of the following varieties, the first three of which should certainly be given a trial where they have not been tested:—Selangor Seedling, BH.10(12), POJ.2727*, POJ.2878 and M.109/26. Since POJ.2878 and M/109/26 have certain faults Planters are not recommended to make extensive plantings of these two varieties before testing them thoroughly.

As considerable local interest in being shown in the performance of the varieties BH.10(12), POJ.2727* and POJ.2878, a summary is given here of the yields of these three varieties in all trials in which they have been tested during recent years:—

TABLE III

	BH.10(12)	POJ.2727*	POJ.2878
Mean yield of sucrose per arpent† and number of trials	4.68 tons (37 trials)	4.98 tons (21 trials)	5.53 tons (19 trials)
Mean yield of standard or controls in the same trials	3.98 tons	4.39 tons	4.35 tons

The main result of these trials to date has been to enhance the reputation of BH. 10 (12), the area under which appears to be steadily increasing, and to temper the enthusiasm for POJ. 2878 which, although it gives high yields, exhibits several serious faults the chief of these being the profusion with which it arrows, its indeterminate growth-habit, the hairiness of its leaf-sheaths and the trouble experienced with its juice in the factory during defecation. As no reports have been received on the behaviour of POJ. 2727 in the factory it is too soon to pass any judgment on this variety but, because

* Referred to erroneously as POJ.2725 in previous reports owing to its having been wrongly numbered when introduced in 1928.

† 1.043 acres.

it usually yields well, and moreover does not arrow so profusely as POJ. 2878 or possess sheath hairs, it is possible that this variety will succeed in the lower parts of the Island where it has already given promising results in recent trials.

In the writer's opinion 4th Nobilised Glagah varieties, such as M. 72/31 and M. 73/31, of the type now being produced and tested by the Station, will prove infinitely superior locally to such 3rd Nobilised types as POJ. 2727 and POJ. 2878 which exhibit rather too many of the characteristics of their wild ancestor.

The results from the variety trials cut in 1935, other than those with new "M" seedlings, are given below together with comments on the performance of the best varieties in each trial:—

TRIAL NO. 73, ST. ANTOINE S.E.						
Variety		Sucrose tons per arpent	Cane tons per arpent	Sucrose % Cane (true richesse)	Purity	Arrows % canes
POJ. 2727 ...	...	4.26	29.6	14.4	88.3	7.4
Selangor Seedling		3.90	26.0	15.0	93.5	3.1
M. 27/16 ...	...	3.61	24.5	14.7	91.7	1.1
D. 109 (white)	...	2.87	20.7	13.9	86.7	0.0
BH. 10(12) ...	...	2.86	19.6	14.6	92.9	0.0
SC. 12/4 ...	...	2.81	20.0	14.0	89.0	0.0
Mean	...	3.39	—	—	—	—
S.E.	...	±0.17	—	—	—	—
Significant difference	...	0.59	—	—	—	—

Virgins aged 13 months. Planted: 27.7.34. Cut: 29.8.35. Irrigated only in early stages of growth. Type of lay-out: randomised block, with border rows discarded.

POJ. 2727 was significantly better than M. 27/16, the standard; D. 109 (white), BH.10(12) and SC. 12/4 were all significantly inferior to M.27/16.

TRIAL NO. 74, RICH FUND, S.E.						
Variety		Sucrose tons per arpent	Cane tons per arpent	Sucrose % Cane (true richesse)	Purity	
Selangor Seedling	...	3.58	21.3	16.8	94.9	
S.W. 499 ...	...	2.96	19.7	15.1	94.5	
BH. 10(12)	...	2.87	19.9	14.4	93.7	
POJ. 2727	...	2.47	17.5	14.1	91.7	
SC. 12/4 ...	...	2.42	16.1	15.0	98.4	
POJ. 36 ...	...	2.30	17.2	13.4	92.4	
POJ. 2940	...	2.20	15.3	14.4	94.4	
Mean	...	2.69	—	—	—	
S.E.	...	±0.10	—	—	—	
Significant difference	...	0.36	—	—	—	

Virgins aged 12 months. Planted: 30.8.34. Cut: 2.9.35. Not irrigated. Type of lay-out: randomised block.

Selangor Seedling was the only variety in this trial to be significantly better than BH. 10(12). All the other varieties, (except S.W. 499) were significantly inferior to BH. 10(12). The variety S.W. 499 is not to be recommended for distribution or propagation in future owing to its susceptibility to Gummydisease.

TRIAL NO. 75, ST. ANDRE S.E.

Variety			Sucrose tons per arpent	Cane tons per arpent	Sucrose% Cane (true richesse)	Purity
POJ. 2878	...	...	6.21	41.4	15.0	92.3
Selangor Seedling	...	...	6.08	41.4	14.7	93.0
POJ. 2727	...	...	5.00	37.6	13.3	89.1
M. 55/1182	...	...	4.89	37.4	13.1	89.7
BH. 10(12)	...	...	4.88	33.4	14.6	89.9
R.A. 30	...	...	4.68	37.8	12.4	88.0
D. 109 (red)	...	...	4.23	32.3	13.1	86.7
Mean	...	...	5.14	—	—	—
S.E.	...	...	±0.13	—	—	—
Significant difference	...	...	0.44	—	—	—

Virgins aged 13½ months. Planted: 29.8 to 1.9.34. Cut: 15.10.35. Irrigated. Lay-out: randomised block, with border rows discarded.

All the varieties were significantly better than D.109 (red), the standard. POJ.2878 and Selangor Seedling were significantly better than all the other varieties.

TRIAL NO. 76, ST. ANDRE S.E.

Variety			Sucrose tons per arpent	Cane tons per arpent	Sucrose% Cane (true richesse)	Purity
M. 109/26	...	...	5.43	35.5	15.3	91.6
M. 14/26	...	...	5.07	35.9	14.1	91.2
D. 109 (white)	...	...	5.04	36.5	13.8	91.1
D.K. 74	...	...	4.96	34.7	14.3	90.0
M. 27/16	...	...	4.86	36.5	13.3	90.8
D. 109 (red)	...	...	4.71	34.9	13.5	89.3
White Tanna (Mon Désert)	...	...	4.48	32.5	13.8	86.0
Mean	...	...	4.94	—	—	—
S.E.	...	...	±0.19	—	—	—
Significant difference	...	...	0.67	—	—	—

Virgins aged 13½ months. Planted: 29.8 to 1.9.34. Cut: 15.10.35. Irrigated. Lay-out: randomised block, with border rows discarded.

M. 109/26 was the only variety to be significantly superior to D. 109 (red), the standard.

TRIAL NO. 78, BEAU CHAMP (TROIS ILOTS) S.E.

Variety			Sucrose tons per arpent	Cane tons per arpent	Sucrose % Cane (factorial)	Purity	Arrows % canes
POJ. 2878	...	...	2.76	19.4	14.2	89.1	6.3
POJ. 2727	...	...	2.58	19.1	13.5	87.9	4.5
BH. 10(12)	...	...	2.24	19.3	11.6	83.9	0.0
M. 23/16	...	...	2.16	18.5	11.7	84.8	0.0
M. 27/16	...	...	1.90	17.0	11.2	84.4	<1
White Tanna	...	...	1.50	11.3	13.3	86.9	<1
Mean	...	...	2.19	—	—	—	—
S.E.	...	...	±0.09	—	—	—	—
Significant difference	...	...	0.31	—	—	—	—

Virgins aged 14.3 months. Planted: 14.9.34. Cut: 25.11.35. Irrigated. Lay-out: randomised block with border rows discarded.

POJ. 2878 and POJ.2727 were both significantly better than BH.10(12), the standard. The low richesse figures recorded in this trial were probably due to heavy rains falling shortly before cutting.

TRIAL NO. 87, ROSE BELLE (NEW GROVE) S.E.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose % Cane (factorial)	Purity	Arrows % canes
M. 23/16 ...	2.76	18.2	15.2	95.1	0.0
BH. 10(12) ...	2.48	15.2	16.3	95.9	0.0
White Tanna ...	2.27	15.4	14.8	91.3	0.0
SC. 12/4 ...	1.95	12.2	16.0	94.1	0.0
POJ. 2727 ...	1.82	11.5	15.8	88.4	0.0
M. 109/26 ...	1.70	10.7	15.9	94.7	0.0
Mean ...	2.16	—	—	—	—
S.E. ...	±0.16	—	—	—	—
Significant difference ...	0.54	—	—	—	—

Virgins aged 12 months. Planted: 20.11.34 Cut: 20.11.35. Not irrigated. Lay-out: randomised block with border rows discarded.

No variety in this trial was significantly better than BH. 10(12), the standard. All varieties, particularly M.109/26, POJ.2727 and SC. 12/4 suffered severely from *Phytlus* attack.

TRIAL NO. 44, REDUIT C.E.S.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose % Cane (true richesse)	Purity	Arrows % canes
BH. 10(12) ...	5.17	34.7	14.9	95.5	0.0
Selangor Seedling ...	4.52	28.6	15.8	93.7	18.7
S.W. 499 ...	4.33	31.4	13.8	91.9	1.0
SC. 12/4 ...	4.27	27.7	15.4	95.0	7.9
POJ. 2940 ...	4.02	26.1	15.4	96.3	55.3
D.I. 52 ...	3.09	19.7	15.7	93.7	0.0
POJ.2747 ...	—	dead	—	—	—
Mean ...	4.23	—	—	—	—
S.E. ...	±0.33	—	—	—	—
Significant difference ...	1.14	—	—	—	—

First-ratoons aged 11 months. Cut: 4.10.35 and in 1934 on 5th November. Not irrigated. Lay-out: randomised block.

The difference between BH. 10(12), the standard, and Selangor Seedling was not significant, but all the other varieties were significantly inferior to BH. 10(12).

TRIAL NO. 45, ST. ANTOINE S.E.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose % Cane (true richesse)	Purity
POJ. 2727 ...	3.62	30.1	12.0	83.7
Selangor Seedling ...	3.17	24.2	13.1	87.2
BH. 10(12) ...	2.48	17.4	14.3	89.0
SC. 12/4 ...	2.45	18.2	13.5	88.9
S.W. 499 ...	2.16	17.3	12.5	85.5
POJ. 2940 ...	1.88	13.5	13.9	89.5
D.I. 52 ...	1.68	12.8	13.2	85.2
Mean ...	2.49	—	—	—
S.E. ...	±0.10	—	—	—
Significant difference ...	0.34	—	—	—

First-ratoons, aged 12 months. Cut: 22.7.35, and in 1934 on 26th July. Not irrigated. Lay-out: randomised block.

POJ.2727 and Selangor Seedling were both significantly better than the standard, BH.10(12). POJ.2727 was itself significantly better than Selangor Seedling. All the other varieties, except SC. 12/4, were significantly inferior to BH.10(12).

TRIAL NO. 15, BRITANNIA S.E.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose% cane (factorial)	Purity	Arrows % canes
Average yield of 18 plots of White Tanna ...	4.32	29.6	14.6	91.3	13.0
Average difference of 5 plots of:—					
M. 23/16 ...	4.32 + 1.27	40.9	13.6	91.4	21.9
M. 27/16 ...	4.32 + 1.09	39.9	13.5	93.8	20.9
M. 13/18 ...	4.32 + 0.67	38.4	12.9	93.6	11.7
M. 26/20 ...	4.32 - 0.22	27.5	15.1	93.6	19.3
M. 5/22 ...	4.32 - 1.43	23.4	12.2	88.8	19.0
M. 7/23 ...	4.32 + 0.06	30.9	14.5	93.7	3.2
M. 9/24 ...	4.32 - 2.20	17.0	13.3	91.3	0.0
M. 6/25 ...	4.32 - 0.37	31.9	12.7	90.8	4.0
M. 14/26 ...	4.32 - 0.44	26.0	14.7	94.2	0.0
M. 109/26 ...	4.32 - 0.38	26.8	14.7	95.5	27.1
BH. 10(12) ...	4.32 + 0.54	30.2	16.0	95.3	0.0
Lab. 111/14 ...	4.32 - 0.70	26.4	13.6	91.3	3.5
POJ. 2727 ...	4.32 + 0.71	30.0	16.4	93.3	41.0
POJ. 2878 ...	4.32 + 2.44	40.2	16.7	95.7	52.1
R.P. 6 ...	4.32 + 1.12	37.3	15.1	94.7	5.9
R.P. 8 ...	4.32 - 1.31	21.9	14.1	90.2	0.0
S.E. ...	± 0.33.				

Second-ratoons aged 12 months. Cut: 4 to 5.11.35, and in 1934 on 5-6 November. Not irrigated. Lay-out: Faulkner plan.

The following varieties were significantly better, in the order named, than White Tanna, the standard: POJ.2878, M.23/16, R.P.6, M.27/16, POJ.2727 and M.13/18. The following were significantly inferior to the standard: M.9/24, M.5/22, R.P.8 and Lab.111/14. The differences between White Tanna and the other varieties in the trial were not significant.

TRIAL NO. 17, REDUIT.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose% cane (true richesse)	Purity	Arrows % canes
Average yield of 8 plots of: R.P. 8 ...	4.89	34.9	14.0	92.4	0.0
Average difference of 6 plots of:					
POJ. 2878 ...	4.89 - 0.09	29.9	15.7	92.8	58.7
POJ. 2727 ...	4.89 - 0.58	25.9	16.2	94.4	31.9
S.E. ...	± 0.42				

Second-ratoons, aged 12 months. Cut: 11.10.35, and in 1934 in October. Not irrigated. Lay-out: Faulkner plan.

The differences in yield between the 3 varieties were not significant.

The Agronomist, the Cane Breeding Officer and my Scientific Assistant were jointly responsible for recording and working out the results of the above yield trials in 1935.

A. GLENDON HILL,
Senior Geneticist,
i/c Sugarcane Research Station.

January, 1936,

TABLE IV
LIST OF CROSSES MADE DURING 1935

I. CROSSES BETWEEN " NOBLE " CANES.

COMBINATION		Location of cross	No. of crosses made	No. of seedlings obtained	No of seedlings planted in field: C.E.S. P.E.S.	
BH.10(12)	x D.K.74	Mon Rêve	1	20	17	—
BH.10(12)	x M.27/16	Mon Rêve	1	25	21	—
Black Tanna	x D.K.74	C.E.S.	1	11	11	—
Black Tanna	x M.27/16	C.E.S.	1	1	0	—
Black Tanna	x SC.12(4)	C.E.S.	1	11	11	—
Louzier	x M.27/16	C.E.S.	1	800	262	—
Louzier	x SC.12(4)	C.E.S.	2	2,500	231	—
M. 20/16	x M.35/17	P.E.S.	1	3,500	—	76
M. 23/16	x M.27/16	P.E.S.	1	200	—	76
M. 23/16	x M.29/16	P.E.S.	1	0	—	—
M. 23/16	x M.26/20	P.E.S.	1	48	—	0
M. 23/16	x SC.12(4)	Mon Rocher	1	25	—	0
M. 23/16	x S.W.499	P.E.S.	1	200	—	0
M. 1/17	x M.35/17	P.E.S.	1	14	—	0
M. 7/17	x D.109, white	P.E.S.	1	600	—	0
M. 7/17	x SC.12(4)	P.E.S.	2	48	—	0
M. 17/18	x D.109, striped	P.E.S.	1	0	—	—
M. 17/18	x M.26/20	P.E.S.	1	20	—	0
M. 33/19	x D.109, striped	P.E.S.	2	800	—	76
M. 33/19	x Louzier	C.E.S.	1	85	0	—
M. 33/19	x M.27/16	P.E.S.	1	700	—	95
M. 33/19	x M.29/16	P.E.S.	1	190	—	76
M. 33/19	x M.109/26	P.E.S.	1	300	—	0
M. 33/19	x SC.12(4)	P.E.S.	1	2,700	—	171
M. 33/19	x Seneville	P.E.S.	1	1,500	—	0
M. 33/19	x S.W.499	P.E.S.	1	2,000	—	0
M. 26/20	x M.109/26	P.E.S.	2	2,150	—	0
M.109/26	x SC.12(4)	P.E.S.	1	2,700	—	190
R.P.6	x M.27/16	C.E.S.	1	1,000	568	—
131.P	x M.29/16	P.E.S.	2	0	—	—
131.P	x SC.12(4)	P.E.S.	2	1,280	—	95
55/74	x D.109	P.E.S.	1	5	—	0
55/74	x M.35/17	P.E.S.	1	2,500	—	0
TOTAL ...			39	25,933	1,121	855

II. INTERSPECIFIC CROSSES.

1. 2ND NOBILISED GLAGAH:

Kassœr	x D.109, white	P.E.S.	2	0	—	—
Kassœr	x D.K.74	C.E.S.	1	5	0	—
Kassœr	x M. 23/16	P.E.S.	1	0	—	—
Kassœr	x M. 27/16	P.E.S.	1	7	—	0
Kassœr	x M. 27/16	C.E.S.	1	25	0	—
Kassœr	x M. 29/16	P.E.S.	2	0	—	—
Kassœr	x M.109/26	P.E.S.	2	24	—	0
Kassœr	x SC.12(4)	P.E.S.	1	27	—	0
Mapou Perlée	x MZ.22/31	C.E.S.	1	72	0	—
TOTAL ...			12	160	0	0

II. INTERSPECIFIC CROSSES—*Continued*

COMBINATION		Location of cross	No. of crosses made	No. of seedlings obtained	No of seedlings planted in field:	
					C.E.S.	P.E.S.
2. 3RD NOBILISED GLAGAH:						
POJ.2364	x D.109	C.E.S.	1	275	124	—
POJ.2364	x D.109, white	C.E.S.	2	175	0	—
POJ.2364	x D.109, white	P.E.S.	1	220	—	79
POJ.2364	x D.1135	C.E.S.	2	9	0	—
POJ.2364	x D.K.74	C.E.S.	1	25	0	—
POJ.2364	x M. 27/16	C.E.S.	1	50	32	—
POJ.2364	x M. 27/16	P.E.S.	1	0	—	—
POJ.2364	x M. 29/16	P.E.S.	1	125	—	82
POJ.2364	x M. 29/16	C.E.S.	1	25	18	—
POJ.2364	x M. 35/17	P.E.S.	1	0	—	—
POJ.2364	x M. 37/26	P.E.S.	2	465	—	173
POJ.2364	x M. 37/26	C.E.S.	2	122	64	—
POJ.2364	x M.109/26	C.E.S.	1	20	0	—
POJ.2364	x M.109/26	P.E.S.	1	225	—	156
POJ.2364	x SC.12(4)	P.E.S.	2	282	—	191
POJ.2364	x S.W.499	P.E.S.	1	40	—	0
POJ.2364	x 87.P	C.E.S.	1	265	60	—
TOTAL ...			22	2,323	298	681
3. 4TH NOBILISED GLAGAH:						
Bambou Rayée	x POJ.2878	C.E.S.	1	35	0	—
BH.10(12)	x POJ.2878	Mon Rêve	2	10	10	—
Bois Rouge	x POJ.2878	C.E.S.	1	16	0	—
Black Tanna	x POJ.2878	C.E.S.	3	5	4	—
Fotiogo	x POJ.2878	C.E.S.	1	5	0	—
Louzier	x POJ.2878	C.E.S.	4	103	70	—
Mapou Perlée	x POJ.2878	C.E.S.	2	2	0	—
M. 20/16	x POJ.2878	P.E.S.	2	1,000	—	158
M. 23/16	x POJ.2878	P.E.S.	2	60	—	52
M. 7/17	x POJ.2878	P.E.S.	3	0	—	—
M. 17/18	x POJ.2878	P.E.S.	1	230	—	197
M. 33/19	x POJ.2878	C.E.S.	2	30	15	—
M. 33/19	x POJ.2878	P.E.S.	2	2,100	118	232
M. 26/20	x POJ.2878	P.E.S.	2	193	—	140
M. 10/22	x POJ.2878	P.E.S.	2	18	—	0
M. 7/23	x POJ.2878	Mon Rocher	1	5	—	0
M.109/26	x POJ.2878	P.E.S.	3	588	—	296
M. 13/29	x POJ.2878	P.E.S.	1	70	—	38
POJ.2727	x D.109	Mon Rocher	2	100	—	57
POJ.2727	x D.109, white	C.E.S.	2	40	21	—
POJ.2727	x D.K.74	C.E.S.	3	5	0	—
POJ.2727	x Louzier	C.E.S.	1	0	—	—
POJ.2727	x M. 23/16	Mon Rocher	4	18	—	0
POJ.2727	x M. 27/16	C.E.S.	2	0	—	—
POJ.2727	x M. 27/16	P.E.S.	1	0	—	—
POJ.2727	x M. 29/16	P.E.S.	1	0	—	—
POJ.2727	x M. 29/16	C.E.S.	1	0	—	—
POJ.2727	x M. 35/17	C.E.S.	1	4	0	—
POJ.2727	x M. 35/17	Mon Rocher	1	10	—	0
POJ.2727	x M. 45/19	C.E.S.	2	108	30	—
POJ.2727	x M. 7/23	C.E.S.	1	0	—	—
POJ.2727	x M. 24/25	P.E.S.	1	5	—	0
POJ.2727	x M. 37/26	C.E.S.	2	7	0	—
POJ.2727	x M. 37/26	Mon Rocher	2	12	—	0
POJ.2727	x M.109/26	Mon Rocher	2	47	—	38
POJ.2727	x M.109/26	C.E.S.	2	0	—	—
POJ.2727	x Penang	C.E.S.	2	1	0	—
POJ.2727	x SC.12(1)	C.E.S.	2	0	—	—
POJ.2727	x SC.12(4)	Mon Rocher	3	25	—	19
POJ.2727	x 87.P	C.E.S.	2	60	20	—

II. INTERSPECIFIC CROSSES—*Continued*

COMBINATION		Location of cross	No. of crosses made	No. of seedlings obtained	No of seedlings planted in field:	
					C.E.S.	P.E.S.
POJ.2878	x BH.10(12)	C.E.S.	4	166	160	—
POJ.2878	x D.109	C.E.S.	3	120	82	—
POJ.2878	x D.109, striped	C.E.S.	2	200	156	—
POJ.2878	x D.109, striped	P.E.S.	1	2	—	0
POJ.2878	x D.109, white	C.E.S.	2	140	30	—
POJ.2878	x D.109, white	Mon Rocher	3	70	—	50
POJ.2878	x D.1135	C.E.S.	2	27	18	—
POJ.2878	x D.K.74	C.E.S.	4	290	190	—
POJ.2878	x Louzier	C.E.S.	3	20	0	—
POJ.2878	x M. 23/16	C.E.S.	2	300	173	—
POJ.2878	x M. 23/16	P.E.S.	3	66	—	46
POJ.2878	x M. 27/16	P.E.S.	2	110	—	55
POJ.2878	x M. 27/16	C.E.S.	4	245	215	—
POJ.2878	x M. 29/16	C.E.S.	3	70	64	—
POJ.2878	x M. 29/16	P.E.S.	1	0	—	—
POJ.2878	x M. 29/16	Mon Rocher	2	160	—	76
POJ.2878	x M. 35/17	C.E.S.	1	5	0	—
POJ.2878	x M. 35/17	P.E.S.	2	0	—	—
POJ.2878	x M. 13/18	C.E.S.	1	70	54	—
POJ.2878	x M. 45/19	C.E.S.	2	1,800	226	150
POJ.2878	x M. 50/19	P.E.S.	1	55	—	38
POJ.2878	x M. 12/21	C.E.S.	1	50	46	—
POJ.2878	x M. 7/23	C.E.S.	1	25	0	—
POJ.2878	x M. 24/25	C.E.S.	1	110	10	—
POJ.2878	x M. 24/25	Mon Rocher	1	0	—	—
POJ.2878	x M. 37/26	Mon Rocher	2	395	—	169
POJ.2878	x M. 37/26	C.E.S.	2	56	10	—
POJ.2878	x M. 37/26	P.E.S.	1	134	—	77
POJ.2878	x M.109/26	P.E.S.	2	525	—	209
POJ.2878	x M.109/26	C.E.S.	7	203	132	—
POJ.2878	x Penang	C.E.S.	2	29	10	—
POJ.2878	x SC.12(4)	C.E.S.	3	195	134	—
POJ.2878	x SC.12(4)	P.E.S.	4	288	—	148
POJ.2878	x Senneville	P.E.S.	1	25	—	19
POJ.2878	x Senneville	C.E.S.	2	35	0	—
POJ.2878	x S.W.499	Mon Rocher	1	0	—	—
POJ.2878	x 87.P	C.E.S.	2	1,200	331	175
R.P.6	x POJ.2878	C.E.S.	2	170	134	—
White Tanna	x POJ.2878	C.E.S.	2	0	—	—
55.P	x POJ.2878	C.E.S. & Moka	5	137	110	—
55.P	x POJ.2878	P.E.S.	1	0	—	—
131.P	x POJ.2878	P.E.S.	2	135	—	72
55/74	x POJ.2878	P.E.S.	1	75	—	57
TOTAL ...			169	12,615	2,455	2,568

4. 5TH NOBILISED GLAGAH:

Ba.11569	x POJ.2940	C.E.S.	1	110	97	—
M.23/16	x POJ.2940	C.E.S.	2	190	108	—
M. 1/17	x POJ.2940	C.E.S.	2	4	0	—
M.33/19	x POJ.2940	C.E.S.	2	49	10	—
M.26/20	x POJ.2940	P.E.S.	1	0	—	—
R.P.6	x POJ.2940	C.E.S.	1	210	108	—
131.P	x POJ.2940	C.E.S.	2	21	0	—
TOTAL ...			11	584	323	—

5. OTHER SPONTANEUM CROSSES:

POJ.2364	x POJ.2940	P.E.S.	1	47	—	37
TOTAL ...			1	47	—	37

II. INTERSPECIFIC CROSSES—*Continued*

COMBINATION		Location of cross	No. of crosses made	No. of seedlings obtained	No of seedlings planted in field:	
					C.E.S.	P.E.S.
6. SACCHARUM-SINENSE CROSSES:						
Ba.11569	x Uba Marot	C.E.S.	1	30	24	—
Black Tanna	x Uba Marot	C.E.S.	1	12	10	—
Louzier	x Uba Marot	C.E.S.	1	5	0	—
M. 23/16	x Uba Marot	C.E.S.	1	60	51	—
M.109/26	x Uba Marot	P.E.S.	2	37	—	19
S.W.449	x Uba Marot	Mon Rocher	2	1,100	—	0
White Tanna	x Uba Marot	C.E.S.	1	0	—	—
131.P	x Uba Marot	P.E.S.	1	1,800	—	0
TOTAL ...			10	3,044	88	19
7. OTHER COMBINATIONS:						
Ba.11569	x M. 39/31 (1)	C.E.S.	1	0	—	—
Ba.11569	x M.196/31 (1)	C.E.S.	1	2	0	—
Ba.11569	x Selangor Seedling	C.E.S.	1	9	0	—
Bambou Rayée	x Selangor Seedling	C.E.S.	1	1	0	—
Bois Rouge	x Selangor Seedling	C.E.S.	1	11	0	—
Black Tanna	x M. 39/31 (1)	C.E.S.	1	2	2	—
Black Tanna	x Selangor Seedling	C.E.S.	2	1	0	—
Fotiogo	x M.196/31 (1)	C.E.S.	1	60	46	—
Fotiogo	x Selangor Seedling	C.E.S.	2	20	14	—
Louzier	x Selangor Seedling	C.E.S.	2	100	68	—
Mapou Perlée	x Selangor Seedling	C.E.S.	1	2	0	—
M. 20/16	x Selangor Seedling	C.E.S.	2	430	360	—
M. 20/16	x Selangor Seedling	P.E.S.	1	1,200	—	198
M. 23/16	x Selangor Seedling	P.E.S.	1	125	—	112
M. 23/16	x Selangor Seedling	C.E.S.	2	20	14	—
M. 1/17	x M.196/31(1)	P.E.S.	1	0	—	—
M. 1/17	x POJ.161	C.E.S.	1	5	0	—
M. 1/17	x Selangor Seedling	C.E.S.	2	7	0	—
M. 7/17	x M. 16/31(1)	P.E.S.	1	2	—	0
M. 7/17	x Selangor Seedling	P.E.S.	1	300	—	183
M. 17/18	x Selangor Seedling	P.E.S.	1	125	—	92
M. 33/19	x Selangor Seedling	P.E.S.	1	750	—	68
M. 33/19	x Selangor Seedling	C.E.S.	2	46	14	—
M. 26/20	x Selangor Seedling	P.E.S.	1	186	—	156
M. 10/22	x M. 16/31(1)	P.E.S.	1	60	—	0
M.109/26	x M. 39/31 (1)	C.E.S.	1	20	7	—
M.109/26	x M.196/31 (1)	C.E.S.	1	110	91	—
M.109/26	x Selangor Seedling	Mon Rocher	1	0	—	—
M.109/26	x Selangor Seedling	Mon Rocher	2	3,000	—	418
M.106/30 (1)	x D.109	C.E.S.	2	210	138	—
M.106/30 (1)	x M. 27/16	C.E.S.	2	0	—	—
M.106/30 (1)	x M.109/26	C.E.S.	2	2	0	—
M.106/30 (1)	x POJ.2878	C.E.S.	2	2	0	—
M. 22/31(1)	x Selangor Seedling	Mon Rocher	1	600	—	182
M. 25/31(1)	x M. 37/26	Mon Rocher	1	14	—	0
M. 25/31 (1)	x POJ.2940	Mon Rocher	1	150	—	104
M. 14/32(2)	x Selangor Seedling	Mon Rocher	1	650	—	343
POJ.2727	x M. 24/31 (1)	Mon Rocher	1	1,000	—	104
POJ.2727	x Uba Marot	Mon Rocher	2	2,800	—	260
POJ.2878	x M. 24/31(1)	Mon Rocher	2	4,500	—	208
POJ.2878	x M.31/31 (1)	C.E.S.	1	2,000	383	—
POJ.2878	x M. 39/31(1)	C.E.S.	1	2,000	326	—
POJ.2878	x M.196/31(1)	C.E.S.	1	500	362	—
POJ.2878	x Uba Marot	C.E.S.	2	2,800	458	—
POJ.2878	x Uba Marot	Mon Rocher	2	6,000	—	338

(1) POJ.2878 x Uba Marot.

(2) M.109/26 x Uba Marot.

II. INTERSPECIFIC CROSSES—*Continued*

COMBINATION		Location of cross	No. of crosses made	No. of seedlings obtained	No of seedlings planted in field:	
					C.E.S.	P.E.S.
R.P.6	x Selangor Seedling	C.E.S.	1	69	36	—
White Tanna	x Selangor Seedling	C.E.S.	1	0	—	—
33.P	x Selangor Seedling	C.E.S.	2	2	0	—
55.P	x Selangor Seedling	P.E.S.	1	30	—	19
131.P	x M. 16/31 (1)	P.E.S.	2	1,200	—	95
131.P	x M. 24/31 (1)	P.E.S.	1	225	—	184
131.P	x M. 34/31(1)	C.E.S.	2	375	94	—
131.P	x M. 41/31(1)	C.E.S.	2	200	126	—
131.P	x M.196/31 (1)	P.E.S.	1	0	—	—
131.P	x Selangor Seedling	P.E.S.	2	1,500	102	388
131.P	x Selangor Seedling	C.E.S.	2	10	0	—
TOTAL ...			80	33,433	2,535	3,452

III. INTERGENERIC CROSSES.

Ba.11569	x S. Munja	C.E.S.	1	115	74	—
M.33/19	x S. Munja	C.E.S.	2	0	—	—
M.seedg.1120/33(3)	x M. Seedg.4004/33	P.E.S.	1	0	—	—
M.seedg.1127/33	x M. 37/26	P.E.S.	1	0	—	—
TOTAL ...			5	115	74	—

IV. SELFINGS.

Louzier	C.E.S.	1	15	0	—
M.23/16	C.E.S.	1	1	0	—
M.23/16	P.E.S.	1	0	—	—
M.26/20	P.E.S.	1	0	—	—
M.109/26	P.E.S.	1	150	—	0
M.216/32	P.E.S.	1	2	—	0
POJ.2878	P.E.S.	1	150	—	0
TOTAL ...		7	318	—	0

V. RECAPITULATION TABLE.

I Crosses between " Noble " Canes	...	39	25,933	1,121	855
II. Interspecific Crosses	...	305	52,206	5,917	6,757
III. Intergeneric Crosses	...	5	115	74	0
IV. Selfings	...	7	318	0	0
TOTAL ...		356	78,572	7,112	7,612

(1) POJ.2878 x Uba Marot;

(3) POJ.2878 x Sorghum.

PART II—BIO-CHEMISTRY

BY N. CRAIG, M. Sc.

The chief work of the division has, during the year under discussion, been chiefly concerned with investigations regarding soil properties and the carrying out of manurial trials in various parts of the island. Laboratory work, however, dealing with soil properties was considerably reduced during the course of the year for several reasons, the chief being that my assistant, Mr. P. Halais, was absent from the Colony on leave of absence, during which he was appointed an official delegate by the Government to the Third International Congress of Soil Science held at Oxford, England, 1935, on which a short report has been submitted. During the crop season, little laboratory work could be attempted, on account of the fact that I had to superintend the reaping of all manurial trials personally, as due to pressure of work in other directions, the services of the Agronomist were not available. A short course on practical methods of soil analysis was delivered to twenty estate chemists, the whole course lasting about ten days. An exhibit illustrating some soil properties of the different types of soil, and also the differences between the surface soil and subsoil was prepared for the Intercolonial Exhibition held in the Champ de Mars, Port Louis, in connection with the Bi-Centenary Celebrations.

The various investigations are briefly described in the following pages.

EXCHANGEABLE BASES

A short account of the total base exchange capacity of the clay and organic fractions was published in the Fifth Annual Report, without however any mention being made of the exchangeable bases which were present. The exchangeable base status with respect to calcium and potash has already been investigated and the work has been extended to manganese and magnesium. This work has been written up as Bulletin No. 9, "Base Exchange Relationships in Mauritius Soils" and consequently need only be described very briefly here. The amount of exchangeable magnesium in the soil was found to vary in the same way as exchangeable potash, i.e. with increased leaching the quantity of magnesium becomes less. The amount found in the most highly leached soils is so small that it is suggested magnesium deficiency may be acting as a limiting factor in these regions. In the dry districts, particularly in the immature soils, there is a fairly abundant supply of exchangeable magnesium.

Although the amount of manganese soluble in hydrochloric acid is much greater in the slightly laterised soils of the dry districts than in the highly laterised soils, yet it is found that the amount of exchangeable manganese actually increases with the degree of laterisation. Obviously, the reason for this must be connected with the form in which the manganese exists in the various soils, and it is suggested that in the more nearly neutral soils of the dry districts it is largely present as manganese dioxide, whereas in the highly laterised acid soils of the wet districts it is not present in this form. Consequently, deficiencies of manganese are more likely to occur in the slightly laterised soils than in the highly laterised ones. The application of molasses may be useful in correcting this possible deficiency, by setting up reducing conditions which favour the formation of exchangeable manganese.

SUBSOILS

In previous reports, investigation into soil properties has dealt principally with differences in the surface soil due to climatic or other variations. It is known, however, that the roots of most crops penetrate the subsoil and the

Physiological Botanist of this Station has pointed out the great depth to which the roots of the sugarcane sometimes penetrate, roots having been found at depths of about 20 feet. Obviously then, the subsoil as a medium for plant growth cannot be ignored, especially when it is considered that part of the subsoil may in the not very distant future become part of the surface soil. Consequently during the year under review, a number of profile studies have been made, with a view to detecting the differences which may occur down to a depth of about four feet.

Pits were dug in four cultivated soils whilst one was also dug in the grey soil at Plaine Lauzun and others in the forest near Mare-aux-Vacoas. The grey and forest soils were included in order that a greater variety of soils would be examined, so that there might be a greater contrast between the results obtained.

Work on some of these profiles is not yet completed, but that which has been done up to the present is briefly described below.

SOIL PROFILE TAKEN FROM FIELD 12, CENTRAL EXPERIMENT STATION, REDUIT.
PROFILE NO. 1.—

Mechanical Analysis and Physical Constants.—The surface soil, which has the usual good crumb structure, contains the normal amount of clay for soils of this nature, the sand fractions being very small. The subsoil immediately below the surface soil contains much more clay amounting to nearly 90% of the soil, the sand fractions being practically non-existent. With increasing depth, however, the proportion of clay becomes less and in the fourth layer from 30 inches to 48 inches in depth, the amount is considerably less than in the top soil, and the fine sand fraction is comparatively abundant, about 13%.

The water contents of the soils at sticky point and at the lower and upper Atterberg plastic limits were also determined. Contrary to expectation, the water contents in the subsoil samples from the various layers were invariably higher at the different points than in the surface soil. This even holds for the deepest layer sampled, 30 to 48 inches, in which, as has already been pointed out, the amount of clay has fallen to 64% against 75% in the surface soil and the respective organic matter contents are 0.5 and 4.1.

Chemical Composition of the Fine Soil and of the Clay Fraction.—The "complete" analysis was performed by the tri-acid extraction method of Follett-Smith, which differentiates between quartz and combined silica.

The so-called quartz decreases with depth, from 9.0% at the surface to 0.7% in the 30 to 48 inches layer. It seems most unlikely that this quartz has been derived from the original rocks which are composed of doleritic basalts, in which quartz is absent. Again, if it were derived from the parent material, it is unlikely that there would be such a marked difference between these two layers. It is probable, however, that primary quartz would appear in the sand fraction, but such cannot be the case in this soil as the total sand fractions amount to 5%. Consequently, it may be that this quartz has arisen as a secondary mineral during the course of soil formation.

From a consideration of the figures for combined water, the molecular silica/alumina ratio and molecular silica/sesquioxide ratio, the degree of laterisation remains practically constant to a depth of four feet. The bulk analysis of the clay fraction leads to similar conclusions, that the mineral part of the soil has a fairly constant composition down to a depth of four feet. Consequently, this work has thrown no light upon the varying behaviour of these soils in their water-relationships as evidenced by the determinations of water contents at the sticky point, etc.

The total base exchange capacity (T), the sum of the exchangeable bases (S) and the pH value were determined for the various samples. Although slight differences were found by the colorimetric method for the pH values of the different layers, they were too small to be considered significant, and it may be stated that down to a depth of four feet, there is no zone of calcium carbonate accumulation. The total base exchange capacity shows a progressive lowering with depth, but the biggest drop occurs between the surface soil and the layer of subsoil immediately beneath it, due to the different contents of organic matter. There is also a progressive lowering of the sum of the bases, but it is much greater than would be expected from a consideration of the pH value and the total base exchange capacity. It has previously been shown that the percentage saturation of the soil absorbing complex at pH 7.0 ($V = \frac{100S}{T}$) shows a very strong positive correlation with the pH value. Consequently it would be expected that the percentage saturation of the soil and different layers of subsoil would remain approximately the same, since the pH values did so. However, the results of these determinations show that the figures drop very considerably in the deeper layers, from 62% at the surface to 23% in the deepest layer examined. Although there is no experimental evidence at present available with these soils, the reason for this difference may lie in the varying ultimate pH values of the different layers.

Plant Foods.—The surface soil is moderately well supplied with matter which has a carbon/nitrogen ratio of 10.7, but the lower layers become increasingly poor and the carbon/nitrogen ratio becomes somewhat closer, about 9.0. Just as organic carbon decreases so does the organic nitrogen, from 0.22 to 0.03, but it appears very doubtful whether this nitrogen in the subsoils becomes available to any large extent due to their undisturbed and therefore poorly aerated condition. Readily available phosphate, as determined by Truog's method is fairly plentiful in the surface soil, but the amount drops to almost one-tenth in the various layers of subsoil and it seems not unlikely that the higher amount in the surface soil is due to past fertiliser applications. A similar state of affairs is noticed in the profile with respect to exchangeable potash.

PROFILE NO. 2.—

This profile was taken at Bega S.E., at an altitude of about 925 feet above sea level, with an annual rainfall of 60 to 65 inches. The soil is mature, of an intermediate type.

The surface soil is fairly deep for Mauritius conditions, being about 12 inches deep, and it is brownish in colour; with increasing depth the colour becomes lighter, until at a depth of four feet the colour is a lighter shade of yellowish brown, with a reddish tinge. Root penetration is good and at the lowest depth signs of roots were readily visible. Below the 12 inches surface there is a distinct change in structure from a well developed crumb structure to a flakey structure. This change in structure is often the best property by which to distinguish between soil and subsoil, as in the field the colour change is sometimes not very well marked. Small black concretions were noticed, especially in the two upper subsoil layers. Below the surface soil there was no sharp change in the subsoil, the change being gradual and progressive and consequently samples were taken representing each foot in depth.

Mechanical Analysis and Physical Constants.—The surface soil, as is to be expected from its morphology, contains about 70% of clay fraction, but only very little of the sand fractions. In the 12 to 24 inches layer, however, there is a definite increase in the clay fraction at the expense of the silt. With

increasing depth, however, the proportion of clay becomes considerably less, the amount of silt remains approximately the same but there is a considerable increase in the fine sand fraction, from 4.5% at the surface to 19% at the 36 to 48 inches layer.

The water contents of the different samples at sticky point and at the upper and lower Atterberg plastic limits were also determined. In spite of the fact that the 36 to 48 inches layer contains least organic matter and clay, this soil has the highest moisture content at the sticky point, the minimum figures being found in the surface soil. The non-sticky plastic range reaches a minimum in the 12 to 24 inches layer, below which it increases considerably. The Atterberg plastic range, however, reaches a maximum in the 12 to 24 inches layer, below which much lower values are obtained.

Chemical Composition.—The surface soil is rather poorly supplied with organic matter, amounting to 3.7%. However, in the second foot layer, the amount falls to less than one-third of this figure and in the third and fourth foot layers to practically nil. There would seem to be a progressive change in the character of the organic matter, the carbon/nitrogen ratio becoming closer with increasing depth. The combined moisture of the surface soil is somewhat less than that of the lower layers, but the differences are not very great. The test for manganese dioxide, i. e. addition of a given weight of soil to 5 ccs. of 50 volume hydrogen peroxide, was very conclusive, rises of temperature of nearly 60°C in one minute being recorded. In the top two layers the reaction was almost violent and in the third layer vigorous but steady. Hygroscopic moisture at 50% R.H. showed a decided increase with depth.

The pH value of the surface soil would appear to be slightly lower than that of the subsoil. Once again, it is found that the percentage saturation of the base exchange complex at pH 7.0 shows a very decided fall on passing from soil to subsoil. The proportion of exchangeable calcium to the sum of the bases rises somewhat in the subsoil, and consequently the subsoil must be less rich in other exchangeable bases. Determinations of exchangeable potash have been made, and much less was found on passing from the first foot to the second foot layer, but below this the quantity increased until in the fourth layer it was approximately the same as in the surface layer. The top soil is fairly abundantly supplied with readily available phosphoric oxide, but the amount falls to about one-sixth in the subsoil layers, and it would appear that the plentiful supply in the surface layer is accounted for by past manurial applications.

PROFILE NO. 3.—

This profile was taken from a pit three feet deep at Belle Rive, Highlands S.E., and was situated at an altitude of about 1,400 feet, with an average annual rainfall of about 150 inches. This field had been out of cultivation for a number of years and was at the time of sampling covered with a close association of *Panicum nossibense*, with frequent *Cyperaceae* and local patches of *Hydrocotyle asiatica*; this association is typical of the grass-land phase of the vegetation of the uplands of the island*. This is a mature soil of the highly laterised type.

The surface soil was about 8 inches deep, at which depth there was a very obvious change in structure; it had a coarse crumb structure and in the wet state was brown in colour. The second layer, from 8 inches to 12 inches, was transitional between the top-soil and the true sub-soil, the colour in the wet state changing from brown to yellowish. Many roots were seen in this

* I am indebted to Mr. P. O. Wiehé for the description of the vegetation growing on this soil and also on that of Profile No. 5.

layer. The third layer, from 12 to 24 inches, was a brownish yellow colour when wet, and it contained few roots compared to the layers above it. The structure was very different from that of the surface layer, no crumb structure being visible, but on breaking tended to form flakes. A fair number of rust coloured concretions were present. The last sample from 24 to 36 inches deep, had a reddish colour and contained iron concretions. It was more flakey in structure and contained only very few roots.

Mechanical Analysis and Physical Constants.—The surface soil contains approximately 50% clay, silt and sand being present in about equal proportions. There is an increase of clay (78.5%) down to the 12 to 24 inches layer, below which the percentage again falls to about 60%, silt and sand each accounting for about 20%. There is a progressive reduction in the amount of organic matter with depth, but even in the deepest layer, there is 1.4% organic matter against 6.3 in the surface layer.

The moisture content of the surface soil at the sticky point is somewhat higher than in the case of the other surface soils, being 50%. In the case of this profile, the water content at this point decreases somewhat with depth. The non-sticky plastic range rises to a maximum in the second layer, below which it drops fairly considerably. The Atterberg plastic range, however, shows a progressive increase with depth, from 14.4 to 27.8.

Chemical Properties.—The hydrogen peroxide test for manganese dioxide shows that this compound is lacking in all the samples, the rise in temperature noted being only 1°C. The combined water, which varies round 22% shows no very marked changes between the different samples, and consequently it may be considered that the degree of laterisation is the same throughout the whole profile to a depth of 3 feet. Organic carbon decreases progressively with depth from 3.65% to 0.81%, and nitrogen from 0.39% to 0.056%. The carbon/nitrogen ratio, however, which has a normal value for the surface soil of 12.5, falls to a minimum of 8.5 in the 8 to 12 inches layer after which it becomes wider, until it reaches 14.5 in the deepest layer examined.

The pH value shows a slight fall with depth from 5.25 at the surface to 4.9 in the bottom sample. As would be expected the total base exchange capacity becomes less with depth, dropping from 20.8 m. gr. eqs.% at the surface to 11.8 m. grs. eqs.% from 24 to 36 inches deep. The sum of the bases is also lower in the subsoil, but in all samples the content is low and practically all these bases consist of calcium. The state of saturation of the base exchange complex is low in all samples, ranging from 7.0% saturation to 1%.

Plant Foods.—In all samples, the amounts of readily available P_2O_5 (as determined by Truog's method) and of exchangeable potash are low, and the differences between the different samples are too small to be really significant. Nitrogen, on the other hand, is fairly plentiful, and in the 24 to 36 inches layer there is still 0.056% nitrogen. The value of this nitrogen is very doubtful as conditions for nitrification are far from ideal.

PROFILE NO. 4.—This profile was taken from a pit slightly more than 3 feet deep at La Ferme Tobacco Station, situated at a height of 450 feet above sea level, with an average annual rainfall of between 25 and 50 inches. This soil is a mature, red soil with a low degree of laterisation.

The surface soil which was somewhat shallow, being only 6 inches deep possessed a crumb structure and had a peculiar chocolate brown colour in the field. The subsoil showed no well marked characteristics, and in general it possessed a flakey structure, the colour gradually changing with depth, from a brownish red, through a light brownish red to red.

Mechanical Analysis and Physical Constants.—As was to be expected for soils of this type, the sand fractions in all layers are only present in small quantity, the clay fraction being by far the most important. The variation in this fraction is from 70% at the surface to nearly 80% in the layer from 12 to 24 inches and 70% from 24 to 36 inches. The silt fraction, which is the next most important increases from 10% at the surface to 24% in the deepest layer.

The moisture at the sticky point shows no very marked differences varying round 42%. The non-sticky plastic range is fairly low, but the Atterberg plastic range is higher than that of the soils previously examined, the range varying from 40 to 26, which seems to indicate that the soil colloids in this type of soil are of a more plastic nature.

Chemical Properties.—The hydrogen peroxide test for manganese dioxide gave rises of about 60°C for the top three layers, but in the fourth the rise was only 9°C. It may be, however, that this comparatively small rise was due to the physical condition as after 10 minutes the temperature had risen by 50°C. It is evident, however, that manganese dioxide is present in all these samples, and it would therefore appear that conditions are highly satisfactory in this soil for the production of this compound.

The combined water remains practically constant in all layers thus indicating that the degree of laterisation does not vary with depth.

The high pH values, ranging from 7.5 at the surface to 7.1 in the deepest layer, found for these samples seems to show that this soil has fairly recently received a fairly heavy dressing of liming materials. The total base exchange capacity, which amounts to 36.7 m. grs. eqs. % dry soil at the surface soil falls to a minimum in the 12 to 24 inches layer, below which it increases slightly. The sum of the bases brings out a very interesting point. As is to be expected from the fact that the pH value of the surface soil is 7.5, the sum of the exchangeable bases found is greater than the total base exchange capacity at neutrality. In view of the fact that the pH values of the other three samples approximate to that of neutrality, it might be expected that the total base exchange capacity, and the sum of the bases would be nearly the same. However, it has been found experimentally that such is not the case, the sum being considerably less than the total exchange capacity. In other words, the percentage saturation of the soil colloids instead of being in the neighbourhood of 100%, varies from 80% to 59%, becoming less with increasing depth. Again, although about 80% of the bases in the surface soil consist of calcium, in the subsoil the amount of this element falls to slightly less than 70%.

Plant Foods.—The readily available phosphoric oxide (as determined by Truog's method) is fairly plentiful in the surface soil, to the extent of 0.008%. In all the subsoil samples, the amount falls to less than one-tenth of the figure above, no very great difference being noted between the three samples. The potash is nowhere very plentiful and it seems to be irregularly distributed, the smallest percentage being found in the 6 to 12 inches layer and the highest in the 12 to 24 inches layer. Both organic carbon and nitrogen show a progressive fall with increase of depth, and at the same time the carbon/nitrogen ratio becomes smaller, the variation being from 9.3 to 6.2.

PROFILE NO. 5.—

This sample was taken at Plaine Lauzun, just past the spur of Pailles Hill on the Port Louis side. It was situated on a slight slope with a northerly aspect, about 175 feet above sea level, with an average annual rainfall of about 30 inches.

The vegetation is a savannah formation with the following Gramineæ occurring as exclusive dominants:—

Heteropogon contortus Beauv.,

Themeda quadrivalvis, Kuntze.,

Amphilopis pertusa, Staph., occurs locally but is seldom dominant. Trees or shrubs occur scattered every 150 or 200 feet and are represented chiefly by Leguminosae, of which *Tamarindus indica*, Linn., and *Albizzia lebbek*, Benth., are the most common.

The grass is usually allowed to flower and cut as litter. Periodically, however, during the dry months of October and November fires are very common, so that the whole area is bare of grass until after the commencement of the summer rains. Various attempts have been made to cultivate this soil without, up to the present, any very great measure of success. A Sisal plantation made about 15 years ago failed, as have some small plantings of maize in the past two or three years. The soil contains a fair number of very finely grained stones which appear to be fairly resistant to the effects of weathering. The surface soil after the mat of vegetation has been removed is very shallow, being only 4.5 inches deep. The soil, which was somewhat moist, was dark grey in colour and the layer contained a large number of roots. From a depth of 4.5 inches to 11 inches, the subsoil became very clayey and small hard rocks were found embedded in a bluish grey clay. At the sides of the pit, where presumably a certain amount of evaporation had occurred, numerous small cracks were visible, indicating a high shrinkage coefficient. In this layer, only few roots were present. From 11 to 39 inches the soil was moister, and it became very soapy and tenaceous, almost gluelike in character. The colour was similar to that above from which it was chiefly distinguished by its nature. Practically no roots were found in this layer. From a depth of 39 inches to the greatest depth reached, viz nearly five feet, the profile showed many differences from the layers above it. When freshly cut, the clay seems to possess a pinkish tinge and in addition it was not tenaceous and gluelike but more brittle in character. Again at a depth of 39 inches, small transparent crystals began to make their appearance, but these increased in size, the major axis of the biggest crystal found being 4.7 cms. long. Moreover, clusters of crystals were common. Definite zoning is apparent and it would appear that there is a very definite cleavage plane, as the crystals readily break into thin sheets. These crystals are composed of gypsum.

The formation of these crystals of gypsum at a depth of about 3 feet in the subsoil is probably due to the fact that during a great part of the year the evaporation is greatly in excess of the rainfall; subterranean water, which may come from the slopes of the hills in the vicinity, where the rainfall is presumably higher than at the lower levels, may bring small quantities of gypsum in solution, which on being concentrated by evaporation deposits crystals in this layer.

Soils with a grey colour are not uncommonly seen, other examples known at present being at Vallée des Prêtres, Yemen and La Mivoie, and it seems not unlikely that these soils are similar in formation to that at Plaine Lauzun. Some cases have been seen of cultivated lands where the soil has possessed a greyish tinge and these spots are noticed where free drainage may be absent, particularly in the low rainfall districts. When free drainage is absent in the higher rainfall districts, then definite marshes may be formed, where the soil is very different from these grey soils.

Up to the present only little analytical work has been performed with this profile as it seems not at all improbable that various modifications will have to be made in the usual analytical methods employed.

The amount of sulphate, soluble in dilute hydrochloric acid was determined in the various layers and calculated in terms of gypsum. In the top three layers the amount in each case is less than 0.25%, whereas in the layer from 39 to 50 inches it amounted to no less than 8.6%. There is little doubt that the majority of this comes from small crystals or from crystals broken during the preparation of the sample.

Mechanical analysis show that this soil is chiefly composed of clay and silt fractions, although in the surface layer the two sand fractions amount to 14%. With increasing depth, however, the amount of sand drops to almost nil, the silt fraction shows a small decrease whilst the clay increases from 56% at the surface to 80% in the gypsum layer. It has already been remarked that the deepest layer was not nearly so glue-like as the layer above it, in spite of the fact that the former contains slightly more clay than the latter. This is probably accounted for by the action of the gypsum in the deepest layer; there may also be a difference in the exchangeable bases at the different depths. The organic matter shows a very decided and progressive reduction with depth, the amount below a depth of one foot being practically negligible. The combined water is very low in the surface soil, but it seems to increase in the second layer, below which a slight fall may take place.

The base exchange relationships have not yet been determined, but the pH values show some interesting changes. The pH value of the top soil is not particularly high the figure being 6.3. After only a slight increase in the second layer, the pH value reaches a maximum of pH 7.5 in the third layer, a small and probably insignificant drop occurring in the gypsum layer.

FOREST PROFILES.—

Three profiles from the forest area near Mare-aux-Vacoas have been examined *in situ* and partially examined in the laboratory, each of them is briefly described below.

PLAINE SOPHIE SECTION 10.

This area had been under scrub jungle with Tatamaka trees, and had been cleared for replanting. The top soil which contained a large number of concretions and which possessed a good coarse crumb structure was brownish in colour and about 9 inches deep. Below the top soil is a layer which contains many concretions, bright red in colour when broken, and still deeper the soil becomes more yellowish with a number of decomposed rocks which seemed to have retained a sandy structure.

Mechanical Analysis.—In the surface soil, all four fractions are fairly well represented, clay being the largest with 31% and fine sand the least with 16%. With increasing depth the coarse sand fraction becomes considerably less, whilst the general tendency is for the fine sand fraction to increase, although the third layer contains less than the second. The silt fraction remains practically constant throughout the whole profile, whilst the clay reaches a maximum in the third layer.

Chemical Properties.—The surface soil is well supplied with organic matter, to the extent of 10.5%, but this amount quickly becomes less so that below 22 inches the amount becomes almost negligible. In every case the amount of combined water is high, corresponding to the most highly laterised of the cultivated soils. The pH value of the surface soil is 5.5, a very low figure, but with depth the value increases somewhat, reaching 5.9 in the layer from 29 to 44 inches deep. The total base exchange capacities of these soils are low and fall with depth, from 21.5 m. grs. eqs. % soil at the surface to 4.4 m. grs. eqs. % in the lowest layer. As would be expected, from the

pH values and from the intense leaching to which these soils are subjected, the sum of the bases is very low varying from 3.0 m. grs. eqs. at the surface to nil in the deepest layer. Once again it is seen that the percentage saturation of the base exchangeable complex becomes less with depth, in spite of the fact that the pH value increases.

The surface soil, which contains 0.0014% available phosphoric acid, is somewhat better supplied with this plant food material than the deeper layers, but still it is not at all rich in it.

PLAINE SOPHIE SECTION 11.

The hole for this profile was dug around the base of a Chinese Pine to a depth of about 3.5 feet.

In the top soil which extends to a depth of 8 inches there are a fair number of concretions. The layer when wet is dark brown in colour and it contains a large number of roots.

Below 8 inches deep, the physical character of the soil changes from a crumb structure to a flakey structure and the colour changes from reddish brown and becomes more reddish gradually. The biggest colour change occurs at about 22 inches deep below which there are concretions and very few roots.

Mechanical Analysis.—In general the mechanical analysis of the different layers are very similar although there is a diminution of the coarse sand fraction and a slight increase in the clay fraction with depth. The clay amounts to nearly 50% of the soil and the silt to between 25% and 30%, so that these soils are composed chiefly of the finer fractions.

Chemical Properties.—The organic matter, which amounts to nearly 7% in the surface soil, rapidly diminishes with depth, so that below 22 inches there is only 1.4% of organic matter in the soil. The combined moisture of nearly 20% is normal for highly laterised soils, and a slight fall is noticed in the deepest layer.

The total base exchange capacity is very low for the top soil, amounting to only 14.6 m. grs. eqs. % soil, the value dropping to about one-half of this for the subsoil. The sum of the exchangeable bases is also very low, the maximum being 1.3 m. grs. eqs. in the surface layer with the result that the percentage saturation of the base exchange fraction at neutrality is extremely low. The pH values increase slightly with depth.

There is not a very big difference between the available phosphoric acid in the different layers, none being at all well supplied with this plant food.

GOODEND, SECTION 2.

In this profile there are many boulders still largely undecomposed. The change in colour from above downwards is, when wet, from brown through reddish brown to brownish red, which layer appeared to be composed of almost completely decomposed rock which has retained its structure. Below this there is a layer of a dark greyish brown colour. Concretions are found in the upper two layers, whilst the third layer is merely decomposed rock, the fourth layer is very soapy in character and it contains some black concretions.

Mechanical Analysis.—The two upper layers, 0 to 10 inches and 10 to 26 inches have very similar mechanical compositions, the clay fraction being about 50% and the silt about 18%, the two sand fractions being approximately the same. The composition of the third layer, i.e. the decomposed rock is very different, however; there is practically no coarse sand fraction, only about 13% clay, but 60% and 26% of fine sand and silt respectively. The layer below this, however, again contains more clay, about 42% and the fine sand and silt are approximately equal at about 26 to 27%.

Chemical Properties.—The organic matter is fairly plentiful in the surface soil, but in the third layer at the depth of 26 to 29 inches, it is practically non-existent. The combined water varies around 20% in all layers, i.e. the normal content for the highly laterised soils.

The total base exchange capacity for all samples is on the low side, the value for the top soil being 17.2 m. grs. eqs. % soil and about one-half of this for the sub-soil. It is worthy of note that the layer with the high fine sand and low clay contents possessed a base exchange capacity almost equal to that of the layers above and below it. All these samples were almost devoid of exchangeable bases, so that they are in an almost totally unsaturated condition. The pH values show practically no variation with depth. The top-soil is slightly richer in available phosphoric oxide than the sub-soils, the amount being rather low in all cases.

In Bulletin No. 9 of the Sugarcane Research Station, it has been shown that in the cultivated soils, the base exchange capacity of the organic matter is independent of the locality from which the soil originated and that the value approximated to 250 m. grs. eqs. % grs. organic matter. The results so far obtained with these forest soils seem to indicate that the organic matter present in them has a much lower base exchange capacity than the value quoted above. Thus in the case of the surface soil from Plaine Sophie Section 10, the total base exchange capacity is 21.5 m. grs. eqs. % soil and the organic content is 10.5%. Thus even if the inorganic fraction has no exchange capacity whatsoever the total base exchange capacity for the organic matter would only be about 205 m. grs. eqs. % organic matter. There is no doubt, however, that the inorganic colloids have a certain value, so that it is almost certain that the value for the organic matter will be well under 200 m. grs. eqs. %. It may be that the organic matter in these soils is humified somewhat slowly and consequently only part of the organic matter has base exchange properties.

BOX EXPERIMENTS WITH SUB-SOILS

In the Fifth Annual Report, a series of beaker experiments dealing with nitrification in soil and subsoil mixtures was described; as a result of these experiments it was shown that the admixture of subsoil with top-soil resulted in a slowing down of the nitrification processes, without totally preventing it and it was suggested that the reduction was due, not to a toxic effect, but to dilution of the active top-soil.

As a continuation of these experiments, it was decided to carry out some growth experiments in boxes with soil and subsoil mixtures. Consequently large samples of top-soil and of subsoil were taken from Field 12, Central Experiment Station, care being taken that there was no mixture during sampling. Small samples, which were subsequently taken from these large samples, were then analysed with the following results:—

	Soil	Subsoil
Nitrogen	0.30	0.15
Carbon	2.66	1.19
Carbon/Nitrogen ratio	8.8	8.0
P ₂ O ₅ sol. in strong HCl	0.25	0.12
P ₂ O ₅ sol. in 1% citric acid	0.0010	0.0004
P ₂ O ₅ by Truog's Method	0.0009	0.0003
K ₂ O sol. strong HCl	0.109	0.084
K ₂ O exchangeable	0.041	0.028
Combined Water	12.7	12.9
pH	5.85	6.10

From these analyses it will be seen that the subsoil is not quite so acid as the surface soil and that the difference between the two with respect to exchangeable and total potash is not very marked. There is a considerable difference with respect to organic matter but there is no doubt that if conditions are satisfactory for nitrification both would be able to supply sufficient nitrates for good growth to be maintained by the test plant. Although the surface soil is rather poorly supplied with available phosphoric oxide, the subsoil is almost devoid of it. On the basis of these analyses, it was decided to test the effect of phosphatic fertilisers and of farmyard manure. The phosphate was supplied in the form of phosphatic guano, which was applied at the rate of 5 grs. per kilo of subsoil in those boxes receiving phosphates, whilst the farmyard manure was added in the dry state at the rate of 100 grs. per kilo of subsoil. The basal treatment was 6 grs. of nitrate of potash throughout.

The boxes were divided into three series:—

A—Soil only.

B—Soil 80%; Subsoil 20%.

C—Subsoil only.

In the B and C series there were four different treatments:—

(1) No extra treatment.

(2) Phosphate added.

(3) Farmyard manure added.

(4) Phosphate and farmyard manure added.

The first test crop grown was maize which was grown at the rate of three plants per box, each of which contained 20 kilos of appropriate mixtures of soil and subsoil. After the crop had been harvested, oats were planted but unfortunately in the boxes making best growth, excessive competition between the individual plants became so great that this trial was abandoned. In the early stages, however, it can be stated that the trial with oats fully confirmed the main results obtained with the maize.

The results of the trial with maize are given in the following table. Total weights of dry matter, including tops and roots, from the various treatments, are given in grammes per box.

TREATMENT:—		1	2	3	4
Series		No extra treatmnt	Phosphates added	Farmyard manure added	Phosphates and F.Y.M. added
A	...	107.2	—	—	—
B	...	92.4	144.8	131.6	150.1
C	...	5.5	103.8	100.2	157.6

From these results it may be seen that the admixture of 20% subsoil with the top-soil has, in the absence of phosphate or farmyard manure applications, resulted in a decreased yield, but that when these have been applied singly or together, an increased yield has resulted. The most interesting series, however, is the C series, i.e. subsoil only. The subsoil with the basal dressing of nitrate of potash, is almost incapable of supporting plant life, as is evidenced by the fact that the total yield per box is only 5.5 grs. against 107.2 grs. in the surface soil. However, the addition of either phosphate or farmyard manure has resulted in such an amelioration that in the boxes C.2 and C.3 the yield is practically the same as in the boxes containing only soil. When the two are applied together then the yield is still further increased, and incidentally the biggest yields of the whole experiment are from these boxes,

In both the B and C series, the addition of phosphatic guano has resulted in a slightly bigger increase than the farmyard manure. That the subsoil is highly deficient in phosphate is shown by the difference between C.1 and C.2. The diminution in yield caused by the admixture of 20% subsoil with the surface soil is in all probability due to the phosphorus status of the subsoil. Hawaiian workers have shown that a subsoil has an even greater power of fixing phosphates in a form which is only difficultly available than has the soil. Consequently the mixing of subsoil with the surface soil may result in a decreased amount of available phosphate.

The beneficial effect of farmyard manure may also be connected with its phosphate content. In the case in point the manure contained 0.8% P_2O_5 , chiefly no doubt in the organic form. Whether the effect is totally due to its phosphate content or not cannot be stated. The effect of the combined application is not equal to the effect of the two separate applications and it seems quite possible that it may be merely a phosphate effect.

The question as to whether the subsoil is toxic or merely sterile has still not been settled, but these experiments show definitely that the subsoil may be made productive if a sufficient supply of phosphates or of farmyard manure be mixed up with it. There seems no reason, therefore, why with deep tillage and heavy applications of phosphatic fertilisers the depth of the top-soil should not be increased in course of time.

The results of this experiment are to be tested in the field, sugarcane being used as the indicator plant.

EXTENSION WORK

At the second meeting of the Research Advisory Committee of the Sugarcane Research Station, it was decided that a short practical course dealing with methods of soil analysis should be held in the laboratories of the Mauritius Agricultural College, in order that estate chemists might become acquainted with recent methods of analysis. The course, which started on April 23rd, lasted for about 10 days, and the response was most gratifying, the chemists from 20 estates attending. In all three lectures were delivered dealing with (a) The classification of Mauritius soils and the characteristics of the different types, (b) The method of taking soil samples and their preparation, (c) The interpretation of the results of analysis. The methods of analysis were explained and demonstrated in the laboratory and each chemist performed sufficient analyses himself to become fully acquainted with the working details to enable him to obtain accurate results.

It is hoped that during the early months of 1936, much work of this nature will be undertaken in estate laboratories. The analyses may be regarded as complementary to the general soil survey which has already been done in the Bio-Chemical Laboratory of the Sugarcane Research Station and and should certainly help to fill in several blanks which exist at present.

During the year, Mr. G. Ducray, Chemist of Queen Victoria S.E., worked in the laboratories of the Agricultural College under my direction, and was engaged in a study of the soils of the abovementioned estate. The results obtained were in general in good agreement with what might have been expected. In all, 30 soil samples from Queen Victoria, Gibraltar, the lower slopes of Mount Fayences, and from a badly drained portion at the foot of the mountain were examined in detail, and the results will form the subject of a further paper; Mr. Ducray intends to continue this work during the next intercrop period. Arrangements have also been made for the Chemist from Beau Champ S.E. to carry out an investigation into the properties of soils from Beau Champ S.E. and its annexes, Olivia and Belle Rive. These soils may probably include practically all the types previously

described in Bulletin No. 4 of the Sugarcane Research Station, as the rainfall varies from about 50 inches per annum at the lower parts to some 125 inches in the upper parts.

MANURIAL TRIALS

During the crop season of 1935, twelve manurial trials were reaped in various parts of the Island; of these four were conducted on the Faulkner plan, three on a paired plot lay-out and five with a randomised block lay-out. Two trials, one with phosphate and one with potash, at Britannia S.E., were abandoned on account of damage done to them by *Phytalus smithi* (Arrow).

During the growing season of 1934-35, good meteorological conditions prevailed for growth, so that in general the yields of experiments reaped during the crop season 1935 have been satisfactory. This refers specially to those parts of the Island which are normally somewhat short of rain.

The four trials conducted on the Faulkner Plan were situated at Sans Souci S.E., two of them dealing with the optimum quantity of nitrogen and two with the optimum quantity of potash. In none of these four trials was a significant increase in yield found, and consequently no definite information can be drawn from them. In previous years, responses have been obtained with nitrogen and with potash applied to both the virgin and first ratoon crops, and the reason for lack of response in the present instance is not clear.

TRIAL 53.

This trial which was continued in first ratoons from the experiment previously reported with the virgin crop was situated at Benares S.E. It was cut as a virgin crop in November 1934 and reaped this year in November, and consequently had approximately 12 months' growth period. The calculated results are given in the following table:—

CALCULATED RESULTS OF TRIAL 53 IN FIRST-RATOONS.

Plot	Treatment	Yield in tons per arpent
1.	No fertilisers	27.96
2.	75 lbs. nitrate of soda	
	125 „ sulphate of ammonia	30.50
3.	100 lbs. sulphate of potash	27.12
4.	75 lbs. nitrate of soda	
	125 „ sulphate of ammonia	
	100 „ sulphate of potash	32.30
5.	150 lbs. nitrate of soda	
	250 „ sulphate of ammonia	31.25
6.	200 lbs. sulphate of potash	29.82
7.	150 lbs. nitrate of soda	
	250 „ sulphate of ammonia	
	200 „ sulphate of potash	31.67
8.	Same as plus 300 lbs. superphosphate	33.1
	General average yield	30.45
	Significant difference between means	2.8 tons

Conclusions.—The single dose of nitrogenous fertilisers (Plot 2) has not quite produced a significant response, but the double dose (Plot 5) has. In neither case has potash (plots 3 and 6) produced any definite result. Although plot 8 has given the heaviest yield, the difference between plots 7 and 8 is not significant. Coupled with last year's results, however, the probability of phosphoric acid increasing crop yields must be admitted. These conclusions are very similar to those drawn from the results with the virgin crop.

TRIAL 66.

This trial, situated at Bel Air St. Félix S.E. was continued in first ratoons from the experiment carried out in 1934 with the virgin crop. It was cut as virgins in November 1934 and reaped as first ratoons at the end of October 1935 and consequently has just over 11 months growth period, the average yield being 34.78 tons of cane per arpent. In view of the fact that no significant results were obtained the results are not quoted, but the following conclusions were drawn.

(a) *Residual effect of Fumier.* The fumier applied to the virgin crop has had no residual effect on this crop.

(b) *Nitrogen.* Although the plots receiving nitrogenous fertilisers gave slightly higher yields than did those receiving none, the differences cannot be considered significant, and consequently it cannot definitely be stated that nitrogenous fertilisers increased the crop.

(c) *Potash.* No evidence was obtained that Potash had in any way resulted in an increased yield.

The results (a) and (b) tend to corroborate those obtained with the virgin crop, but (c) does not.

TRIAL NO. 70.

This trial, which situated at Bel Air St. Félix S.E. was qualitative in character and was planted in February 1934, with the cane variety BH.10(12).

The trial was reaped in September 1934 and the results, with the manurial treatments of the various plots, are given in the following table:—

CALCULATED RESULTS ON TRIAL NO. 70.

Plot	Treatment	Yield in tons per arpent
1.	No extra fertilisers	... 46.6
2.	250 kgs. superphosphate	
	200 „ sulphate of potash	
	200 „ sulphate of ammonia	... 45.8
3.	250 kgs. superphosphate	
	200 „ sulphate of potash	... 47.6
4.	250 kgs. superphosphate	
	200 „ sulphate of ammonia	... 46.4
5.	200 kgs. sulphate of potash	
	200 „ sulphate of ammonia	... 46.5
6.	Same as (2) plus 15 tons fumier	... 45.0
	General Mean	... 46.3

The "z" test shows that the treatments have had no significant effect upon the yields.

In view of the fact that no significant differences were discovered, it would appear that the field in question was in a very high state of fertility so that all treatments failed to produce any response.

TRIAL NO. 71.

This trial which was planted in May 1934 at Benares S.E. was reaped in November 1935. The various treatments together with the calculated results are given in the following table:—

CALCULATED RESULTS OF TRIAL 71.

Plot	Treatment	Yield in tons per arpent
1.	No treatment	30.9
2.	150 lbs. mixture 40% nitrate of potash and 60% sulphate of ammonia —	
	12 tons manure	
	200 lbs. mixture 40% nitrate of potash and 60% sulphate of ammonia	31.9
3.	100 kgs. nitrate of soda	
	250 „ sulphate of ammonia	30.95
4.	400 kgs. superphosphate	32.95
5.	150 kgs. sulphate of potash	31.4
6.	100 kgs. nitrate of soda	
	250 „ sulphate of ammonia	
	400 „ superphosphate	31.5
7.	100 kgs. nitrate of soda	
	250 „ sulphate of ammonia	
	150 „ sulphate of potash	31.7
8.	400 kgs. superphosphate	
	150 „ sulphate of potash	31.6
9.	100 kgs. nitrate of soda	
	250 „ sulphate of ammonia	
	400 „ superphosphate	
	150 „ sulphate of potash	29.6
	General Mean	31.4

Again in this trial the differences are too small to be significant, and consequently the trial fails to give any reliable information as to the manurial requirements of the soil.

TRIAL NO. 72.

This trial, which was planted at Beau Bois, St. Aubin S.E., early in 1934, with the cane variety BH.10(12), was reaped late in September 1935. Unfortunately the second application of artificial nitrogenous fertilisers, i.e. 200 kgs. sulphate of ammonia, to plots 3, 5 and 6 was omitted due to an oversight; if this had not been the case, then the yields from these plots might have been considerably higher.

Treatments actually given to the different plots, together with the calculated results, are given in the following table:—

CALCULATED RESULTS OF TRIAL 72.

Plot	Treatment	Yield in tons per arpent
1.	Nil	49.81
2.	Usual Estate Method	56.17
3.	400 kgs. phosphatic guano	
	200 „ sulphate of potash	
	200 „ nitrate of soda	56.38
4.	400 kgs. phosphatic guano	
	200 „ sulphate of potash	49.90
5.	200 „ sulphate of potash	
	200 „ nitrate of soda	57.40
6.	400 kgs. phosphatic guano	
	200 „ nitrate of soda	56.65
	General Mean	54.40
	Significant difference between means	3.44

The chief points of interest in this trial are first that the omission of phosphatic guano and sulphate of potash from the complete artificials has not resulted in any decrease in crop yields. Secondly, when the 200 kilos of nitrate of soda is omitted from the artificials, then a significant decrease in yield follows, the amount being about 6.5 tons per arpent. It is but reasonable to presume, therefore, that if the 200 kgs. of sulphate of ammonia had been applied, some increased yield might have been expected from plots 3, 5 and 6. That plots 2 and 3 should have given almost identical yields seems to indicate that fertilisation with artificials only may replace the use of farmyard manure plus artificials, at least temporarily. If the sulphate of ammonia, which was accidentally omitted from the three series of plots, had been applied and it had given a response as the nitrate of soda did, then the artificials only would have yielded better than the plots receiving fumier. Finally, the similarity in yields between plots 1 and 4 offers further evidence that lack of phosphate and potash are not limiting factors in this soil.

TRIAL No. 90.

A nitrogen and phosphate trial was conducted in a field of BH.10(12), 2nd ratoons, on similar lines to that reported in the Fifth Annual Report of the Sugarcane Research Station, at St. Antoine S.E. This trial was reaped at the beginning of August 1935. The various treatments and calculated results are given in the following table:—

CALCULATED RESULTS OF TRIAL 90.

Plot	Treatment	Yield in tons per arpent
1.	200 kgs. sulphate of ammonia	23.44
2.	Nil	19.64
3.	200 kgs. sulphate of ammonia	
	300 „ superphosphate	22.72
4.	300 kgs. superphosphate	19.94
	General average	21.44
	Significant difference	2.7

The results of this experiment show that treatments 1 and 3 are definitely better than treatments 2 and 4, respectively, and consequently nitrogen is sure to produce increased yields in the conditions of this experiment. On the

other hand, there is no significant difference between treatments 1 and 3 and between 2 and 4, so that phosphatic fertilisers have failed to produce any response. The results of this experiment bear out the results of the previous experiment on this estate.

FARMYARD MANURE *v/s* ARTIFICIALS TRIAL AT RICH FUND S.E.

In view of the interest shown in the respective merits of farmyard manure and artificial fertilisers, a trial was conducted at Rich Fund S.E. in co-operation with Mr. O. d'Hotman, Chemist of Highlands S.E. There were only two treatments given, as follows:—

" S " PLOTS	" A " PLOTS
5 tons scums per arpent	End of Feb. 34, 200 kgs. phosphatic guano, 100 kgs. sulphate of potash and 150 kgs. nitrate of soda.
20 tons fumier per arpent	End of April/34, 200 kgs. phosphatic guano, 100 kgs. sulphate of potash and 150 kgs. nitrate of soda.
Fertiliser mixture of equal parts of sulphate of ammonia and nitrate of potash:	End of June/34, 50 kgs. sulphate of ammonia.
March/34 ... 50 kgs. mixture	Nov-Dec/34 100 kgs. sul. of ammonia.
May/34 ... 50 " "	
December/34 ... 50 " "	

The results obtained are as follows:

Average yield of 8 " S " plots	... 52.7 tons per arpent.
" " 6 " A " "	... 51.0 " " " "
Significant difference	... 3.6 " " " "

Although the yield of the " S " plots is somewhat higher than that of the " A " plots, the difference is not significant, and consequently no reliance can be placed upon the difference. Mr. M. de Chazal reports that this field has not had any dressing of pen-manure for about 20 years and consequently it would appear that manure can efficiently be replaced by artificials, at least for the virgin crop.

TRIAL No. 69.

This experiment was conducted at the Central Experiment Station with the special object of investigating border effect in manurial trials. Only two series of plots were introduced, four of series " A ", and five of series " B ", each plot consisting of six rows of thirty stools. The kinds of fertiliser applied were the same for both series of plots, but series " B " received exactly four times as much as did series " A ".

In order to detect any border effect, it is first of all necessary to ensure that there is a highly significant difference between the yields of the differently treated plots. Consequently a piece of land which was of so low fertility that it had been abandoned for a number of years, was selected for the experiment. The treatment afforded to the different plots was as follows:—

Date of application	A Quantity given per arpent	B Quantity given per arpent
Planting)	3-4 tons fumier	3-4 tons fumier
Feb/34 }	50 kgs. phosphatic guano	200 kgs phosphatic guano
27. 3.34	50 kgs. superphosphate	200 kgs. superphosphate
	25 " nitrate of potash	100 " nitrate of potash
	12.5 " sul. of ammonia	50 " sul. of ammonia
16. 6.34	12.5 kgs. nitrate of potash	50 kgs. nitrate of potash
	25 " sul. of ammonia	100 " sul. of ammonia
22.11.34	37.5 kgs. sul of ammonia	150 kgs. sul. of ammonia

From the time of planting up to the middle of November 1934, this trial suffered somewhat from the dry conditions which prevailed during that year, but from November 1934 onwards it enjoyed good growth conditions until it was reaped in August 1935. During the whole of its growth, the "B" plots looked very much better than did the "A" plots and it was obvious that the former would easily outyield the latter at harvest, when each row was weighed separately. Furthermore, out of four of the plots, 2 "A" and 2 "B" plots, 100 stools from each were weighed separately and the number of canes and arrows in each stool counted.

The extent to which the canes in one series of plots have been affected by the treatment given to those in the other series of plots may be judged by grouping together (a) all the outside rows of the several plots of each series, (b) the two centre rows and (c) the intermediate rows. The mean weight for these various combinations and the Standard Deviations can then be calculated, the results being given in the following table:—

	"A" SERIES		"B" SERIES	
	Mean Yield	S.D. (of mean)	Mean Yield	S.D. (of mean)
a. Outside rows ...	240.8 kgs.	22.8	393.6 kgs.	19.6
c. Intermediate rows ...	208.9 kgs.	12.9	368.1 kgs.	15.7
b. Two Centre rows ...	209.2 kgs.	16.9	368.2 kgs.	7.3

These figures show that there is no significant difference between any of the differently situated rows of either series. However, the actual average figures show that the outside rows of both series of plots have given higher yields than the inner rows, whereas there is no difference between the intermediate rows and the two centre rows. It may well be, therefore, that the outer rows of all plots have benefitted as a result of the adjacent plots. If such is the case, the increase in the outer rows of the "A" plots is undoubtedly due to the fact that these canes have been stimulated to a certain extent by the fertiliser applied to the "B" plots. The only way that any possible increase in the outer rows of the "B" plots can be explained is by the fact that the food supply in the soil was more than sufficient for them, and due to the fact that they were definitely taller than the canes in the adjacent "A" plots, they benefitted by reduced competition for light and air.

How does the inclusion of the border rows affect the calculated results? In the following table the results are calculated from (a) all six lines included, (b) the two border rows of each plot excluded, and (c) only the two centre rows of each plot included.

COMPARISON OF CALCULATED RESULTS, BASED ON THE WEIGHTS OF SIX, FOUR AND TWO LINES PER PLOT

RESULTS GIVEN IN TONS OF CANE PER ARPENT.

		Six lines	Four lines	Two lines
Average yield of 5 "B" plots ...	...	40.2	39.2	39.1
Average difference of 4 "A" plots ...	...	-16.9	-17.5	-17.55
S.E. ...	...	1.46	1.47	1.60

These results show that the heavier application of fertilisers has resulted in an increased yield amounting to about 17 tons of cane per arpent, and consequently if border effect is of any great importance it should be very marked in this case. However, the results in the above table show that the

results are practically the same whether the border rows are included or not, in that the difference in yield and the S.E. of the difference are almost the same, although a slight increase in the standard error of the difference is noticeable when the results are calculated from the weights of the two centre rows only.

As a result of this experiment then, it appears highly improbable that the results of any of the manurial experiments reaped in the past, where there has been no provision made for the elimination of border effect, have been seriously affected by this omission, and that the results as published are reliable. The elimination of the border rows from the experiment, however, has one big advantage, in that when these rows of cane are left standing, it very efficiently prevents any danger of mixing adjacent plots.

Samples were taken from each plot for analysis, and the results obtained are given in the following table:—

		Sucrose		P ₂ O ₅ %	K ₂ O %
		% cane	Purity	mls juice	mls juice
" A " plots ...	...	12.80	89	0.0041	0.025
" B " plots ...	...	12.61	91	0.0033	0.039

The difference between the sucrose content of the " A " plots and of the " B " plots is certainly not significant. The reason why there should be less P₂O₅ in the juice from the highly fertilised plots than in that from the plots receiving small applications is obscure unless this variety of cane has a very low requirement, so that 0.0041 grs. in 100 ccs. juice is more than is required. The treatment has increased the amount of K₂O in the juice quite appreciably.

Other points have been investigated in this trial, but it is intended to publish these at a later date.

31st January, 1936.

N. CRAIG,
Bio-Chemist.

PART III—RESEARCH BOTANY

By

H. EVANS, Ph. D.,

INTRODUCTION

The Physiological Botanist was away on leave from March 23rd to December 8th. During this period the programme of research formulated at the beginning of the year was continued as far as was possible by Mr. d'Emmerez de Charmoy. In the root work the studies of root-development in BH.10(12), POJ.2878 and White Tanna up to six months of age were completed, also the effect of subsoiling on root growth, and considerable progress has been made on the effect of fertiliser application at a depth, on the growth of the buttress roots. Work on the qualitative and quantitative nature of shoot and root growth in subsoil to which the various substances were added has been completed. Field experiments involving the practical application of the root studies have been laid out and are proceeding satis-

factorily. The experiment on the growth rate of cane under conditions of abundant nitrogenous nutrients has been completed and the results analysed. The *Phytalus* resistance trials were continued, and the results obtained to date are presented in this report. An investigation on the early root development of seedlings, and the inheritance of root characters in seedlings has been commenced. This investigation was in addition to the problems put forward in the research programme for 1935. The data accumulated for the purpose of determining the best size and shape of plot for field experiments with sugarcane have been sent to Rothamstead at the request of Mr. F. Yates, Chief Statistician, who is having the data analysed in detail.

Several exhibits were prepared by the Physiological Division for the Bi-Centenary Exhibition at Port Louis. Among the exhibits which attracted much attention was a reconstructed root-system of the variety White Tanna at six months of age. Photographs of a considerable number of other reconstructed systems were shown, together with plans and diagrams illustrating the technique of the methods used, and examples of the types of sugarcane roots.

Mr. d'Emmerez attended as demonstrator during the Exhibition, explaining the sugarcane root studies to those interested. The progress of investigations already initiated are dealt with below, under the appropriate headings.

ROOT INVESTIGATIONS

In previous investigations data have been obtained on the earliest stages of germination from the cutting, and the development of buttress roots, and later of the superficial system has been elucidated. The mature root-systems of all the important varieties grown in Mauritius either commercially or as parents for breeding purposes, have also been investigated in considerable detail in one particular environment. The varietal differences in root-habits under the conditions obtaining at Réduit have now been satisfactorily established, and the data may confidently be used as a general index of the nature of the root-system in different varieties. The results have been published in detail in Bulletin No. 6 of the Sugarcane Research Station.

The data previously obtained on the actual development of the root-system was, however, rather meagre, and it was considered desirable to study this phase in more detail. Three varieties were used, viz: BH.10(12), White Tanna and POJ.2878, special plantings being made for the purpose. Determinations were made at 2, 3, 5 and 6 months of age for stools of each of these three varieties. Conditions of growth were exceptionally good during the whole period of the experiment. The root-systems were examined by the Block Method.

The detailed description of the root-development with photographs of the reconstructed root-systems will be published elsewhere. Some of the relevant data are summarised in Table I. These data show that the interline is very intimately explored by the roots even when the canes are only 2 to 3 months old. This has its bearing on cultivation practices for it will be apparent that cultivation of canes must not be delayed owing to the extensive damage to the root-system which must result. The data suggest that even in canes of 3 months of age, the damage can be very appreciable and there is little doubt that cultivation should be carried out as early as possible, and certainly within 2 to 3 months.

TABLE I

Age (months)	White Tanna	BH.10(12)	POJ.2878
2.	Longest roots, 32"; average length of roots, 20 to 25 ins; maximum depth of roots, 2 ft.; average depth of buttress roots, 1 foot; Total No. of roots, 175. {No. of superficial roots, 155. {No. of buttress roots, 20. Few sett roots.	Longest roots, 36"; average length of roots, 24"; maximum depth of roots, 1 ft.; average depth of buttress roots, 6" to 1 ft.; Total No. of roots, 136. {No. of superficial roots, 102. {No. of buttress roots, 34. Few sett roots.	Mostly sett roots. Longest roots, 30"; average length of sett roots, 15"; average length of superficial roots, 6". Very few buttress roots. Maximum depth of system, 18". Total No. of roots, 37.
3.	Longest superficial roots, 42"; average length, 28 to 30 ins; lateral spread of system, 2 feet; maximum depth of buttress roots, 2 ft. Total No. of roots, 311. {No. of superficial roots, 275. {No. of buttress roots, 26. Very few sett roots.	Maximum length of superficial roots, 5 ft. Mean spread, 4 ft. Lateral spread of buttress roots, 2 ft. Maximum depth of buttress roots, 2 ft. 6 ins. Mean depth, 2 feet. Branching sparse. Very few sett roots.	Maximum length of superficial roots, 34". Mean spread, 24 to 28". Maximum depth of superficial roots, 14". Buttress roots pass down more or less vertically. Maximum depth of buttress roots, 24 to 27"; mean depth, 12 to 14". Total No. of roots, 250. {No. of superficial roots, 216. No. of buttress roots, 34. Few sett roots.
5.	Longest superficial roots, 5 ft. Mean spread of superficial system, 3 to 3½ ft. Maximum depth of buttress roots, 3 to 3½ ft. Average depth, 2½ to 3 feet.	Longest superficial roots, 4 ft. Mean spread of superficial system, 2½ ft. Maximum depth of superficial system, 18". Maximum depth of buttress roots, 3 ft. Branching sparse.	Maximum length of superficial roots, 4 ft. Mean superficial spread, 2½ ft. Lateral spread of buttress system, 1 foot. Maximum depth, 3 ft.; average depth, 2 to 2½ ft.
6.	Maximum spread of superficial roots, 6 ft. Mean spread, 4½ ft. Superficial system extensive to depth of 18". Maximum depth of buttress roots, 4 ft; average depth, 3 ft. Lateral spread of buttress system, 4 ft. Branching profuse.	Maximum length of superficial roots, 4½ ft. Mean spread, 3 ft. Maximum depth of system, 5 ft. Mean depth of buttress system, 3½ to 4 ft. Small rope system present. Branching rather sparse.	Maximum length of superficial roots, 4 ft. Mean spread, 2½ to 3 ft. Maximum depth of buttress system, 4 ft. Mean depth, 3 ft. Lateral spread of buttress roots, 2 ft. Small rope system present, penetrating to 5 feet,

SUMMARY OF ROOT DEVELOPMENT IN WHITE TANNA, BH.10(12) AND POJ.2878

There are certain features in the early development of the root-system, which are common to all three varieties. These are the initiation of root growth by the sett, giving rise to the temporary sett-roots, and the gradual taking over of root functions by the shoot-roots. Up to six months of age the shoot-roots consist almost exclusively of the two classes of roots which have been described as superficial roots and buttress roots. The primary shoots (those formed directly from the sett) bear almost exclusively superficial roots. When they do bear buttress roots also, these originate at a later date than the superficial roots. The secondary shoots, on the other hand, (i.e. those shoots originating from the primary shoots) and shoots of a higher order, bear a large number of buttress roots and these almost invariably protrude before the superficial roots which may also be borne on these canes. It appears plausible to suggest that the greater vigour of secondary shoots and those of a higher order as compared to the primary shoots, may be due to the former being equipped with an adequate buttress system in addition to superficial roots. The buttress roots have already been shown to be of great importance in the water-economy of the sugarcane.

There are, however, marked differences in the rate of growth of the root system in the three varieties, the order of merit being White Tanna, BH.10(12) and POJ.2878. Under the favourable conditions occurring during the whole growing period, White Tanna had a root system at 6 months of age which approximated closely to the mature root system of this variety. The other two varieties at the same age had still much progress to make to reach the mature stage of the root-system. In BH.10(12), the mature root system had a much greater depth than the 6 months old system, but in POJ.2878 the mature root system was more extensive altogether as regards spread, number of roots and depth to which the roots penetrated, than the 6 months old system. There is, therefore, a marked difference in the rate of development of the root-system in the three varieties, POJ.2878 being outstandingly slow; this is in accordance with the behaviour of the three varieties in the field.

THE EFFECT OF SUBSOILING ON ROOT DEVELOPMENT

Considerable interest has recently been aroused amongst planters on the subject of subsoiling. Subsoil-cultivation is carried out with an implement which is capable of breaking up the subsoil in situ. It has not been established as yet whether such treatment may cause an increase in yield under normal conditions, but there is some evidence that it may be beneficial in the control of *Phytalus smithii*, the operation resulting in a mortality of some larvae. It has been thought, following preliminary experiments, that the depth of root growth might be favourably affected by the operation, and the work herein described was designed to investigate this problem. Two varieties were used, viz: BH.10(12) and White Tanna and the root systems were examined in detail by the block method at 3 months of age. Subsoiling was done by carefully removing the top soil, and then breaking up the subsoil to a depth of about 3 feet from the surface, the top soil being then replaced in its original position. Controls were examined at the same time.

1. *White Tanna*.—At 3 months of age, there was no apparent difference in the aerial portion of the stools; there was, however, a remarkable difference in the root system. The most striking difference lies in the depth and density of the roots. Even in the surface soil, root development was more vigorous in the treated plots. Superficial roots were longer, more numerous and

branched to a far greater extent, in the treated plot, this being probably due to the loosening of the surface soil as a result of its removal and subsequent replacement, suggesting that even a cultivation of the top soil has a very beneficial effect on root growth in this region, the absorbing surface being considerably increased. The distinction between thick and thin superficial roots observed in the control stools was not so marked in the treated stools. The mean spread of the superficial roots in the control stools was $4\frac{1}{2}$ to 5 feet, whereas in the treated stools it was 6 feet.

As would be expected, the greatest effect of subsoiling has been on the buttress system. The remarkable fact emerged that the nature of the buttress roots was fundamentally affected by the treatment. The buttress roots were modified so as to appear almost identical to superficial roots, except as regards their lighter colour. They did not show any of the distortions which are usually typical of these roots; they were cylindrical and ribbed to a slight extent; they branched profusely giving rise not to the thick, flattened, secondaries which they usually bear, but to thin secondaries bearing profuse fibrous rootlets along their entire length. Buttress roots were more numerous in the treated stools, and their lateral spread had extended to four feet, with no sharp delimitation. Some buttress roots had penetrated to $3\frac{1}{2}$ feet, while most terminated at a depth of about 3 feet. There are, therefore, at this stage of development only a few roots which have penetrated beyond the subsoiled region. In those few which had done so, that portion which had penetrated the undisturbed subsoil showed the normal features of buttress roots. It appears, therefore, that the typical characteristics of buttress roots are not inherent in these roots, but are caused by the nature of the subsoil in which they are located.

II. *BH.10(12)*.—The root-system of *BH.10(12)* was also markedly affected by the subsoiling treatment, there being a considerable increase in depth and number of roots, as was observed in White Tanna. Branching was also more prolific than in the untreated stools, though not nearly so profuse as in White Tanna. As stated above, branch roots are normally more sparse in *BH.10(12)* than in White Tanna.

Buttress roots assumed the features of superficial roots in the treated stool of *BH.10(12)* as described for White Tanna. There is even a greater difference in the distribution of roots between the treated and untreated stools of *BH.10(12)* than was found in White Tanna. The root system of the treated stools had a mean spread of $5\frac{1}{2}$ feet, with some superficial roots $4\frac{1}{2}$ feet long, and a mean depth of $3\frac{1}{2}$ feet, with a few penetrating to 4 feet.

To summarise, subsoiling had a very marked effect on the root-system of the two varieties investigated, the treated stools having a greater spread and depth, the roots being also more numerous and more profusely branched. The main differences between buttress roots and superficial roots disappeared as a result of the treatment, the former assuming the features of superficial roots. Unfortunately, the very convincing photographs of reconstructed systems from the treated and untreated plots cannot be included in this report, but will be published separately.

DETERMINATION OF THE ABSORBING POWER OF ROOTS

Owing to the pressure of other work, and the absence of the Physiological Botanist on leave, only the preliminary preparations for this work could be carried out. Special plantings of cane varieties have been made for this purpose and in the near future, the accurate determination of the absorbing power of roots will be effected by a method involving the counting of root hairs on the various classes of roots.

PHYTALUS RESISTANCE TRIALS

(a) *Trial No. 1.*—The preliminary results of this trial have already been published (*Revue Agricole de l'Île Maurice*, May-June, 1935). In this paper the result of heavy infestation of *Phytalus* larvae on young canes was described. On June 26th, 1935, the application of a second dose of larvae was begun, the canes at this time being 16 months old. It was thought that the varieties might respond differently to *Phytalus* at this age, owing to the differential growth and development, particularly of the root-system, which has already been demonstrated. Unfortunately, larvae could not be supplied until late June and by this time they were almost mature. For this reason 90 larvae were added to each stool instead of 80 as used in the first infestation, but even so the effect of the larvae was very small. The length and diameter of all the canes in the experiment were again measured before the second infestation, to see how far the canes had evened up after the first *Phytalus* attack.

Mean values of the volume of cane, before and after the infestations of *Phytalus* larvae for the treated and control plots are given in Table II below.

TABLE II

Mean Vol. of cane per stool (ccs)				
	Before 1st infestation	After 1st infestation	Before 2nd infestation	After 2nd infestation
White Tanna I ...	68.4	287.7	11045.3	10641.5
White Tanna C ...	85.4	499.0	10142.1	9322.4
M.104/30 I ...	141.2	1445.0	22735.1	Canes had flowered and growth stopped during period of infestation.
M.104/30 C ...	170.9	2393.7	23478.4	
Uba I ...	53.4	439.8	10544.6	
Uba C ...	28.7	442.4	16012.9	
BH.10(12) I ...	61.5	352.7	9633.0	7378.0
BH.10(12) C ...	47.0	538.8	14075.6	14573.9
R.P.8 I ...	83.1	767.3	11051.3	11605.4
R.P.8 C ...	130.7	503.0	8708.3	8713.7
D.1135 I ...	134.4	662.5	11312.3	11177.0
D.1135 C ...	83.1	709.1	11667.1	11674.0
POJ.2878 I ...	63.3	402.4	12371.1	Flowered
POJ.2878 C ...	61.9	480.1	17582.0	Flowered

It will be seen that there are very large varietal differences in the growth following the end of the first larval activity. In the case of White Tanna the growth of the infected canes have not only caught up but passed slightly that of the control canes. The infected stools of M.104/30 and D.1135 have also caught up with the control canes. On the other hand in BH.10(12) and R.P.8 the growth of the infected canes was still very inferior to that of the control canes. In Uba and POJ.2878, where there was very little difference between the infected and control canes soon after the end of the first larval activity, there is now a very marked effect, indicating a delayed result of *Phytalus* attack in these two varieties.

The effect of the second infestation is indeterminate, in that the growth even of the control canes had almost ceased by this time. There was, however, in all cases a small loss of volume following the second infestation, this being undoubtedly due to a slight drying up of the canes, resulting in a decreased diameter. There is no apparent explanation of the quite marked decrease in the volume of cane in the White Tanna controls in this interval.

Profuse flowering had occurred in M.104/30, Uba and POJ.2878, resulting in a complete cessation of growth soon after the second infestation, so that cane volume could not be expected to increase. In passing, it is of interest to note that no difference in the degree of flowering of the infested and control canes could be established.

The whole trial was eventually harvested and the weight of cane from each plot determined.

Taking the final yield of the infected plots as the criterion of *Phytalus* resistance M.104/30 was by far superior to any of the other varieties. Owing to the loss of cane from several of the control plots due to over-ripening, no significant difference between infected and control plots could be established at the end of the experiment in the case of White Tanna, M.104/30 and POJ.2878. In the other varieties the difference between control and infected plots was still very marked. It is, therefore, impossible to classify the varieties in their order of *Phytalus* resistance at the time of harvesting, except on the basis of final yield of infected plots. On this basis the canes fall in the following order of merit:—M.104/30, Uba, White Tanna, POJ.2878, R.P.8, D.1135, BH.10(12).

It will be seen that the order of merit shows large changes during the season; this will be apparent from the following table, which gives the order of merit at different periods:—

TABLE III

After 1st infestation		Just before 2nd infestation		Harvested after 2nd infestation
M.104/30	...	M.104/30	...	M.104/30
D.1135	...	POJ.2878	...	Uba
R.P.8	...	D.1135	...	White Tanna
Uba	...	White Tanna	...	POJ.2878
POJ.2878	...	Uba	...	R.P.8
BH.10(12)	...	BH.10(12)	...	D.1135
White Tanna	...	R.P.8	...	BH.10(12)

The inconsistency of the order of merit at the three periods may be due to various factors, e.g. (1) soil variability between plots (the nature of the experiment of necessity making it impossible to evaluate this variability); (2) a difference in the number of surviving larvae, this causing a difference in the degree of attack; (3) a difference in recovering power after *Phytalus* attack. It is advisable to concentrate attention, therefore, on the consistent features of the table, viz that M.104/30 is undoubtedly superior to any of the other varieties; that BH.10(12), R.P.8 and probably White Tanna are very susceptible, and that Uba, D.1135 and POJ.2878 though showing inconsistent behaviour are probably moderately resistant.

(b) *Trial No. 2*.—This trial included some of the varieties used in Trial No. 1, but in addition some extra varieties were included. Iron sheets were placed between the plots to isolate the larvae, instead of the trenches which were dug between the plots in Trial No. 1. This prevented excessive drying out of the soil in the plots. The varieties included in this experiment were POJ.2727, SC.12(4), POJ.2878, M.196/31, BH.10(12), Selangor Seedling, M.108/30. The volume of cane per stool before and after infestation are given in Table IV below.

TABLE IV

	Vol. of cane after 1st infestation (18.6.1935)	Vol. of cane after 2nd infestation (7.11.1935)	Absolute increase in volume	Percentage increase in volume	Difference in favour of control canes	Standard error of differences	Significant or not
POJ.2727 C	...	3438	6262	2824	+ 50.1	15.5	Significant
POJ.2727 I	...	5507	7281	1774			
SC. 12/4 I	...	4535	9864	5329	- 18.5	19.55	Not Significant
SC. 12/4 C	...	4021	9765	5744			
POJ.2878 I	...	7556	12457	4901	+ 70.4	23.99	Significant
POJ.2878 C	...	5252	10886	5634			
M.196/32 I	...	16647	26800	10153	- 14.6	14.09	Not Significant
M.196/31 C	...	15712	28423	12711			
BH.10/12 I	...	5001	10924	5923	+ 62.8	21.46	Significant
BH.10/12 C	...	4249	11485	7236			
Selangor Seedg. I	...	9447	16454	7007	- 20.8	16.33	Not Significant
Selangor Seedg. C	...	6150	11306	5156			
M.108/30 I	...	9486	13519	4033	+ 3.0	9.1	Not Significant
M.108/30 C	...	11142	16447	5305			

The same difficulty as that mentioned in Trial No. 1, viz: the difficulty of getting a sufficient supply of *Phytalus* larvae at a young enough stage, was experienced in this experiment also. For this reason larvae could not be supplied until the middle of June, by which time the larvae were almost fully grown. It will be seen from the above-mentioned table that a reduction in growth due to *Phytalus* could only be proved in three varieties out of the seven in the experiment.

The difficulty of knowing whether the degree of infestation is equal in all the plots is an inherent disadvantage in this type of experiment, since although the same number of larvae are supplied, the percentage survival could not be determined without uprooting the canes, thus making it impossible to determine the effect of a second *Phytalus* infestation on the canes at a later stage.

Assuming that the degree of attack has been equal in all the varieties, it is probable that those varieties which showed a significant decrease in growth due to *Phytalus* are less resistant to attack than those which failed to show such a decrease. On this basis, SC.12(4), M.196/31, Selangor Seedling and M.108/30 are more resistant to *Phytalus* than POJ.2727, POJ.2878 and BH.10(12). The fact that M.196/31 and M.108/30 (both POJ.2878 x Uba Marot seedlings, like M.109/30 in trial No. 1,) are found amongst the resistant group, and BH.10(12) amongst the non-resistant group, constitutes evidence for the significance of this result, since it is consistent with the results from Trial No. 1.

The results obtained to date on the *Phytalus* resistance of varieties appear to indicate that this method of experimentation is not suitable for the accurate determination of resistance. The labour and time necessary to carry out these resistance trials are excessive, and the method cannot be used as a routine method of testing new varieties. It is also of importance to note that a mean infestation of 30,000 larvae per acre on estates causes a very marked effect on growth whereas in this experiment the application of a far greater number had only mediocre effects.

It appears that a knowledge of the percentage survival of the larvae is essential, and in an experiment on the lines described above this is impracticable. It is possible that a method similar to that described previously (Ann. Rep. Sugarcane Res. Stn., 1933, p. 52) is the most suitable for the determination of *Phytalus* resistance. In the meantime the evidence tends to show that seedlings such as M.108/30 of the cross POJ.2878 x Uba Marot are by far the most resistant to *Phytalus* attack. Planters are recommended to test this promising variety which was released for general distribution in 1935.

SETT-SOAKING TRIALS

No new sett-soaking trials have been laid out but the yields in ratoons have been followed. Previous results have been summarised in the Annual Reports (1933-34). The trial at Trianon S.E. was harvested as first ratoons, the following being the yields obtained:—

Mean yield of 34 control plots	...	...	28.54 t.p.a.
Average difference of 8 "A" plots	...	...	+3.20 t.p.a.
" " 8 "B" "	...	...	+1.61 "
" " 8 "C" "	...	...	+2.47 "
" " 8 "D" "	...	...	+2.12 "
Standard Error of differences	...	±1.55 t.p.a.	

The effect of soaking the setts in a saturated solution of lime (treatment "A") has thus caused a significant increase in yield of first-ratoons (a significant increase in the yield of virgins has been demonstrated previously). The effect of the other solutions are in this case of doubtful significance,

The trial at P.E.S. was harvested as 2nd-ratoons with the following results:—

Mean yield of 30 control plots	...	...	28.7 t.p.a.
Average difference of 7 "A" plots	...	...	+1.78 t.p.a.
" " 7 "B" "	...	...	+4.13 "
" " 7 "C" "	...	...	+2.33 "
" " 7 "C" "	...	...	+1.01 "
Standard Error of differences	...	± 0.95 t.p.a.	

Here also in the case of all solutions used for soaking (with the exception of water only) a significant increase in yield has been obtained even in 2nd-ratoons. The lime magnesium sulphate, however, appears to be the best in this experiment, whereas in previous results, lime alone was the best.

It is considered that the beneficial effects of soaking have been amply demonstrated, and it is of interest to note that several planters are now adopting this procedure.

EXPERIMENTS ON METHODS OF APPLICATION OF FERTILISERS

Two field trials to investigate the efficiency of different methods of application of fertilisers have been initiated, one at Labourdonnais S.E. and one at Rose Belle S.E. The experiments will be described in detail when the results are available.

THE EFFECT OF A LATE APPLICATION OF NITROGENOUS FERTILISER ON THE GROWTH AND PHYSIOLOGY OF SUGARCANE

An experiment to determine the effect of a late application of nitrogenous fertiliser (Ammonium sulphate) on the growth and physiology of sugarcane was carried out at Ebène S.E. using the variety Rich Fund No. 1. The experiment was designed to elucidate certain problems which had cropped up as a result of the Course of Growth experiment described in Bulletin No. 7 of this Station.

In addition to the normal practice of the estate in which 60 kgs. of ammonium sulphate, 40 kgs. nitrate of potash and 75 kgs. guano phosphate per acre were applied, the canes in the experiment were given 500 kgs. sulphate of ammonia on February 9th, 1932. In this latter application the fertiliser was spread uniformly over the interline, and between the stools in the rows. The length of cane was determined at weekly intervals, following the application. Observations were kept on the degree of arrowing, and the canes were weighed and samples prepared for analysis at the time of harvesting.

The results will be published in detail elsewhere, only a brief summary of the results will be given here.

There was no significant difference in the rate of growth of individual canes following the application of the sulphate of ammonia, but there was a significant increase in the number of canes per stool, resulting in an increased yield at the time of harvesting, as follows:—

Mean yield of control plots	...	=	39.9 tons per arpent.
" " treated "	...	=	48.0 " "
Difference in yield	...	=	+ 8.1 t.p.a. $\pm$ 2.4 t.p.a.

There was a striking difference in the degree of flowering between the control and treated plots.

No. of canes which flowered	{ Control plots	...	25.43% $\pm$ 1.34
as a percentage of total	{ Treated plots	...	11.47% $\pm$ 1.61
Difference of arrowing			= 13.96 $\pm$ 2.1.

The sulphate of ammonia has therefore resulted in a very significant decrease in the degree of arrowing of the canes as compared with the control canes. A factory analysis on samples of cane from the two plots for specific gravity, Brix, purity, sucrose, juice content per cent, bagasse and fibre per cent, etc., were made. No significant difference could be established between the control and treated plots, apart from a slight tendency for lower purity, greater water-content, and smaller bagasse content in the treated canes, but even in these cases the odds were only between 2 and 5 to 1, and therefore quite insignificant.

A morphological analysis of samples of cane from the two plots were also made as regards number of internodes, internode lengths, weight of leaves per unit length of cane, etc. There was no significant difference between the control and treated stools. Mineral analysis of samples of cane from the treated and control plots have not yet been completed.

THE NATURE OF THE ABNORMAL GROWTH SYMPTOMS WHEN SUGARCANE IS GROWN IN SUBSOIL

The experiment was not designed to determine the identity of any possible deficient element, or that of any possible toxic principle in the subsoil, but it was thought that a knowledge of the growth characters obtaining when sugarcane was grown in subsoil as compared to top-soil, might be used for the diagnosis of similar growth features when occurring in the field. Single-eye cuttings were grown in moist sawdust in preparation for the experiment, and only young plants as similar as possible were used. The young plants were transplanted into used petrol cans of 4 gallons capacity. The treatments were as follows:—Subsoil alone, subsoil *plus* lime, subsoil *plus* lime *plus* complete artificial fertiliser, subsoil *plus* complete fertiliser, subsoil *plus* complete artificial fertiliser. Controls consisted of plants grown in top-soil only, and in top-soil *plus* complete chemical fertiliser.

The treatments containing lime suffered a set-back at the beginning of the experiment, this undoubtedly being due to a burning effect of the lime. For this reason, the plants grown in subsoil alone had a healthier appearance than those grown in subsoil *plus* lime, and subsoil *plus* lime *plus* fertiliser, at the end of the first month. Later, however, the plants in these pots recovered and were eventually very superior to those in subsoil alone.

1. *Subsoil alone*.—These plants showed the poorest growth of all the treatments. At first they were small but healthy looking, but at the end of the second month, the leaves began to develop a yellowish green colour, and growth was practically at a standstill. The canes did not tiller at all in subsoil alone, the plants having only one shoot. This shoot was very small in diameter, and the leaves borne on it were also very narrow. Only 3 to 4 new leaves formed for 4 months. After the first 4 months growth in length of the shoot had also ceased. Plants 8 months old consisted of one thin shoot, 20 to 25 cms. long bearing a few thin yellowish green leaves.

2. *Subsoil plus Lime*.—Those in subsoil *plus* lime after the original set-back, recovered and by the time they were three months old they were definitely superior to those grown in subsoil alone. The leaves had a yellowish colour in this treatment also, though not as pronounced as in subsoil. At five months of age the plants produced some side-shoots though these were few in number. The leaves lost some of their yellowish appearance, but never became fully green they were also longer, broader and more numerous than in subsoil alone. Root growth was much better than in subsoil alone. The plants were, however, very small and puny even at 8 months of age.

3. *Subsoil plus Lime plus Fertiliser*.—Plants grown in subsoil *plus* lime *plus* fertiliser also suffered a severe set-back at the beginning of the experiment, two plants of this treatment died at the end of the first month. The remaining plants, however, recovered and in 4 months time were definitely superior to the two treatments described above. The leaves were yellowish in this treatment also, and tillering was very slight. There had been very vigorous root development the proportion of the whole plant which consisted of roots was far higher in this treatment than in any of the other treatments.

4. *Subsoil plus Fertiliser*.—Plants grown in subsoil *plus* fertiliser without the addition of lime did not show a set-back at the beginning of the experiment and the plants looked healthy and fairly vigorous one month after planting. Growth, however, decreased after this early stage, though not to the extent occurring in subsoil alone. No side shoots were developed. The leaves were yellowish, though the yellowing was not so marked as in the treatments described above. The plants were similar to those grown in subsoil *plus* lime *plus* fertiliser except that no side shoots were formed.

The plants grown in subsoil to which "fumier" had been added showed an outstandingly better growth than all the treatments which did not include "fumier."

5. *Subsoil plus Farmyard Manure*.—In the first month after planting, the plants in this treatment were markedly superior to all the treatments described above. This superiority was maintained throughout the period of the experiment. Unlike the four treatments enumerated above, the leaves were of a healthy, normal green colour and were longer and wider and more numerous. Vigorous tillering occurred. The main stems were the thickest of all treatments in the experiment. The plants in this treatment developed to what was probably the maximum possible in the confined space available. They showed cane at the base when they were about 8 months old.

6. *Subsoil plus Farmyard Manure plus Complete Fertiliser*.—There were no marked differences between this treatment and treatment 5, both being far superior to the other treatments. The canes started better in this treatment than in treatment 5, but this superiority was not maintained. The canes in treatment 5 were slightly better than those of this treatment at the end of 8 months. Tillering, though vigorous, was not as marked as in treatment 5. However, secondary shoots were first found in this treatment.

At the end of the experiment the plants were dug up in completeness and the soil washed away from the roots. There were very marked differences in root growth between the various treatments, the root weights not of necessity corresponding to the aerial parts. The largest weight of roots occurred in treatment 3, there being an average of 443 grms. of roots per stool in this treatment. Treatments 5 and 6 were next with 297 grams and 119 grams respectively and subsoil alone was least with 15 grams. There had thus been a difference in type of growth in the various treatments resulting in very marked variations in the shoot root ratio from 0.133 in treatment 3 to 0.882 in treatment 6.

The results make it clearly apparent that the subsoils of Mauritius are not alone capable of sustaining growth, that the addition of lime and artificial fertilisers while causing improved growth are not highly efficient, while the addition of farmyard manure in considerable quantity, on the other hand, appears to render normal growth possible.

In all cases the weight of roots formed a much larger proportion of the total stool than is normally the case. The fact that the addition of farmyard manure to subsoil appears to promote good growth incidentally confirms the

Bio-Chemist's conclusion that a deficiency of organic matter and mineral elements mainly phosphate rather than the presence of a toxic substance is the cause of the poor growth of sugarcane in subsoil.

PUBLICATIONS

Three bulletins were published during the year. In bulletins Nos. 5 and 6 the root investigations were described in considerable detail. The results of the course of growth experiment in a virgin crop of sugarcane was published in Bulletin No. 7.

Contributions were sent to the *Revue Agricole*, and papers prepared for publication in the *Empire Journal of Experiment Agriculture*.

Réduit,
January, 1936.

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APPENDIX—LIST OF PUBLICATIONS OF THE SUGARCANE RESEARCH STATION, DEPARTMENT OF AGRICULTURE

I.—BULLETINS

Bulletin No. 1 :

- (a) Results of manurial experiments harvested in 1931 and 1932;
- (b) Results of variety yield trials harvested in 1931 and 1932;
by N. Craig, M.Sc., (1933)

Bulletin No. 2 :

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For publications of the Department of Agriculture, other than those of the Sugarcane Research Station, application should be made to the Director of Agriculture, Réduit.